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TREASURY DEPARTMENT

Public Health and Marine-Hospital Service of the United States

WALTER W. MAN, Surgeon-General

HYGIENIC LABORATORY.—BULLETIN No. 40

M. J. ROSENAU, Director

May 25, 1908

Biological
& Medical
Serials

- 1.—The Occurrence of a Proliferating Cestode Larva (*Sparganum proliferum*) in Man in Florida. By Ch. Wardell Stiles.
- 2.—A Reexamination of the Type Specimen of *Filaria restiformis* Leidy, 1880—*Agamomermis restiformis*. By Ch. Wardell Stiles.
- 3.—Observations on Two New Parasitic Trematode Worms: *Homalogaster philippinensis* n. sp., *Agamodistomum nanus* n. sp. By Ch. Wardell Stiles and Joseph Goldberger.
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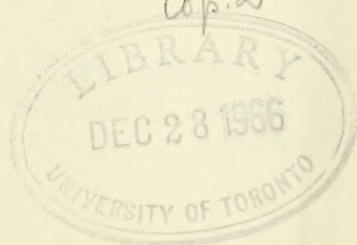
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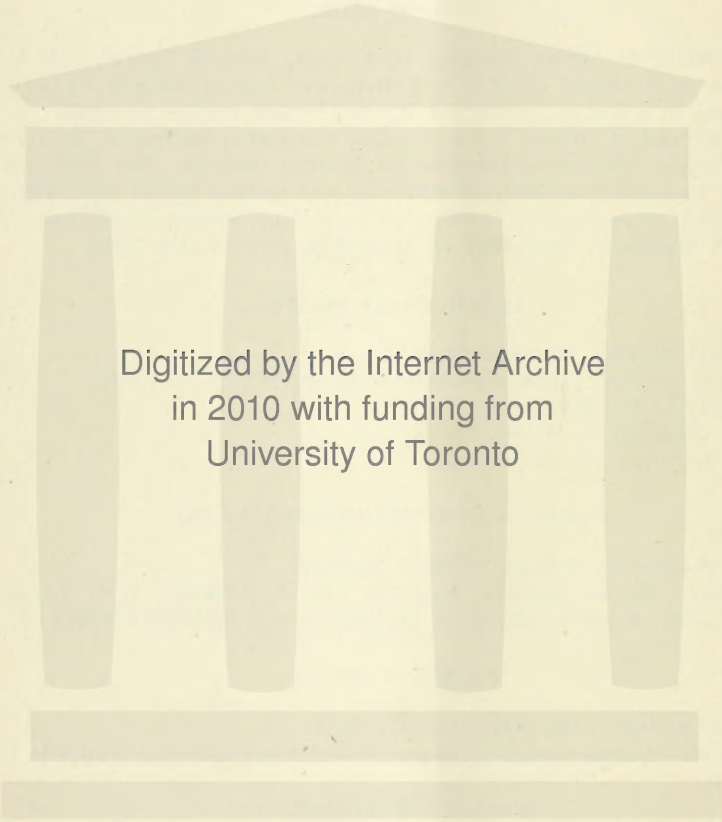
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SUMMARY.

This bulletin contains four articles on parasitic worms.

I. A very peculiar case of parasitism in man in Florida has been found by Doctor Gates, of Manatee. The worms, which live in the subcutaneous tissue and cause an acnelike swelling, have been determined as very closely related to, perhaps identical with, *Sparganum proliferum*; this parasite has been reported on only one former occasion (1905), when it was found in Japan; its life history, source of infection, prevention, and treatment are still unknown; its chief peculiarity is a reproduction in its larval stage by means of forming supernumerary heads, which may become independent and wander through the tissue.

II. *Filaria restiformis* is a worm described as a parasite from man. The original specimen has been found and restudied. It proves to be an immature horse hair worm and it is therefore exceedingly doubtful whether it was a parasite of man.

III. Some parasites referred to us by an official in Manila and Phrapatoom, collected from the cecum of cattle (*Bos* —) prove to be a new species of trematode (*Homalogaster philippinensis*). Some parasites collected from the partridge (*Francolinus subtorquatus*) in West Africa by Dr. F. C. Wellman, and referred to us by the American Society of Tropical Medicine, prove to be an agamic encysted new species (*Agamodistomum nanus*) of trematode, rather closely related to the genus *Clinostomum*. It is impossible to state at present whether or not it is transmissible to man, but it does not agree with any form at present known for man; it is not known at present for any game or other birds in the United States.

IV. A few segments of the original specimen of *Tenia abietina* have recently been found. They are in very poor condition, and this precludes any final judgment as to their exact systematic position. They appear as a dwarfed specimen of *T. saginata*, yet there are certain indications which point to a difference from that species. For the present the form may perhaps best be viewed as a possible subspecies of *T. saginata*.

All bibliographic references are taken from Stiles and Hassall, Index-Catalogue of Medical and Veterinary Zoology, Authors, Bull. 39, U. S. Bureau of Animal Industry.

All drawings were prepared by Leonard H. Wilder, artist of this laboratory.

THE OCCURRENCE OF A PROLIFERATING CESTODE LARVA (SPARGANUM PROLIFERUM) IN MAN IN FLORIDA.^a

By CH. WARDELL STILES, Ph. D.,

*Chief of Division of Zoology, Hygienic Laboratory, U. S. Public Health and
Marine-Hospital Service.*

(Figs. 1 to 18.)

MEDICAL HISTORY OF THE CASE.—In June of this year (1907), I received from Dr. H. Gates, of Manatee, Fla., specimens of worms, for identification, which he had taken from the skin of a man. The following extracts from Doctor Gates's letters give all that is known to me regarding the medical history of the case. In connection with this history, it will be well to abstract in considerable detail an account of a very similar case recently reported by Ijima (1905) in Tokyo, Japan.

Gates's case.—Inclosed find specimens of worms from human flesh. They are inclosed in sacks deep under the skin in the connective tissue. My patient has thousands of them all over the trunk; they can be seen and felt as nodules; deeper in the connective tissue in the left groin and left breast there seem to be large masses of them. I send some I obtained by cutting open the nodules and squeezing them out, and others still in the cyst as I found them.—From letter dated June 17, 1907.

In reply to your request for history, etc., of patient (J. W. M.) infected with larval tapeworm, I would state that I first discovered the condition in April of this year. I was called in to treat him for dysentery. While examining over abdomen I found a great many nodules in the skin and also in the fascia between the skin and the muscles. Deep down in the abdominal cavity I found large and small tumors, some movable and others fixed by adhesions. All the lymphatic glands on the side most infected were enlarged and in masses, as if they had formed close union with surrounding tissue.

The muscles were exempt from nodules, but soft and flabby. I opened one nodule near the surface and obtained two worms. Most of the nodules on the

^a This article forms part of a paper which, by permission of the Surgeon-General, was presented upon invitation before the Sixth International Dermatological Congress, in New York, September 9-15, 1907.

skin are about the size and shape of grains of rice. When they first appear there is an itching produced. The cyst is filled with a clear watery fluid in which is found the small worm. In a few days a cyst wall is formed, surrounding the worm, which lies in a jelly or slime like substance. After weeks or months the cyst wall becomes firm, and surrounds one or more worms. In some cysts I have found as many as three worms. In the course of a few months the cyst wall breaks and there is nothing left but, sometimes, a blue spot showing a small hemorrhage; after this is absorbed, there will be only a spot of indurated tissue to mark the place. The places that have been infected the longest appear as a mass of indurated skin and fascia closely connected so that the skin can be picked up only with the mass of worm and tissue.

Patient is now 48 years old. He came to Florida in 1872 from Minnesota and settled with his father on a point on the Manatee River, now known as Manns Point, which was accessible to fish and oysters.

When 23 years old, while hunting in the woods about $1\frac{1}{2}$ miles from the coast, he noticed a small pimple on the left shoulder, which attracted his attention because of the itching. He thought the skin had been punctured by a thorn. He squeezed the lump, from which came a small flat worm about $\frac{1}{16}$ -inch wide and $\frac{3}{8}$ -inch long. One year after the first appearance on the shoulder, he noticed four or five small lumps on his chest; these he opened with a knife and he picked out the same kind of worms; these swellings also had produced an itching sensation. Patient was then living as fisherman on Sarasota Bay.

While fishing, patient's diet consisted of smoked and dried fish, raw oysters, scallops, and clams. Up to five or six years ago he was a robust, healthy specimen of manhood, but lacked energy. At present he has a tired expression, has less energy, and becomes exhausted after little exertion.

From the photographs (figs. 1 2) you will see enlargement of the left breast and shoulder; also of left groin and lumbar region. Spleen and liver are enlarged.

The infection is slight on the right side.

Patient has a wife and five children, all of whom are healthy.

There probably was another case similar to this a few years ago in this county. I have been trying to obtain a history of it, but have failed thus far. The man moved from here to California, where he died. The report was that he was eaten up with worms before he died.—Extracts from letter, August, 1907.

Japanese case.—The patient was a Japanese woman, Yae Tanaka by name, resident in Tokyo or immediate vicinity. Before her marriage to a dealer in old furniture she was a weaver, "occupations which place her decidedly in the lower class of society."

At the age of 33 years, in the spring of 1904, she visited the University Hospital at Tokyo for treatment for left inguinal hernia, entering the surgical wards of Dr. J. Kondo. This hernia was traceable to the presence of parasites in the region of the ligamentum poupartii. In addition to the hernia, she presented a peculiarly swollen condition of the integument, which bore scattered spots of acnelike appearance. This abnormal condition extended over nearly the entire body, except on the face and upper extremities; it was most prominent on the left thigh, which was greatly swollen and presented very much the appearance of elephantiasis, although the skin and underlying tissues were quite soft, so that they hung down by their own weight and could be grasped in a flaccid mass by the hand.

When 25 years old the patient had a tapeworm, the species of which is not known. The dermal affection was first felt when she was 31 years old, so that at time of entrance to hospital it was of about two years' standing. It had given no particular trouble beyond that imposed upon motion by the

swollen thigh and the itching of the skin in parts where a pimplelike hardening made its appearance; scratching with the nails, in order to allay the itching, had led to breaking the skin, from which a soft whitish mass, together with some fluid, could be pressed out. A number of resulting recent scars, especially on the breasts, were visible.

In preparations, made of skin taken from the left thigh, Ijima became convinced of the presence in the connective tissue of numerous encapsuled worms, the cestode nature of which was recognized from the calcareous corpuscles.

On each of two subsequent occasions, July 9 and 24, 1904, a very large piece of skin, with the underlying connective tissue, was excised from the left thigh, in order to relieve the patient of the superfluous tissue. Altogether several pounds in weight were removed during the patient's stay at the hospital.

When freshly excised the subcutaneous tissues presented an unusual appearance. At places several centimeters thick they were moderately rich in panniculus adiposus and extraordinarily rich in lymph; the latter swelled the connective tissue between the panniculi, giving it a slimy or gelatinous appearance and consistency; the slimy character seemed more manifest in the deeper parts; lymph exuded copiously from the cut surfaces; numerous capsules, with the contained worm, were observable as whitish objects, isolated or in clusters, in all parts of the tissues. The thickness of tissues between the surface and the underlying tissue measures 30 to 60 mm., notwithstanding the fact that the hardening process has contracted the subcutaneous connective tissue, through loss of the lymph, into dense fibrous bundles, so that it no longer bears a resemblance to what it was in the fresh state. The corium in the same piece may be said to be 3 to 6 mm. thick; it seems to be on the whole considerably thicker than in the normal state.—Abstracted from Ijima, 1905, pp. 1-21.

Further medical details are not given by Ijima, but he states that Professor Kondo will publish a report of clinical and pathological observations. I have not as yet learned of the publication of the report in question.

From the foregoing abstracts the suspicion immediately arises that in Florida we have a skin infection, hitherto unrecognized for the American continent, and similar to, perhaps identical with, an infection recognized only on one former occasion, namely, in Japan.

It is interesting to note the following comparison in the cases, without laying too much stress upon these points at present:

Both cases occurred near the eastern shore of the continents in question (Old World, between 35° and 36° N., and New World, between 27° and 28° N.); both patients lived in or near cities or towns located directly on the water, very near larger bodies of water (Pacific Ocean and Gulf of Mexico); both patients, though of different sex, were adult (23 years, male; 31 years, female) when the infection was first noticed; both patients belonged to the poorer class of society; one had a professedly fish diet, the other lives in a country where a fish diet is very common; both infections are of long standing (in one case over three years, in the other case about twenty-five years): in both cases the number of individual worms present was very great; both observers (Ijima for Japan and Gates for Florida) independently call attention to the acnelike lesion resulting from the infec-

tion: each patient is a native of the country in which the case was found, and in neither case is there any history given of the patient's having visited the country of the other patient.

NATURE OF THE PARASITE.—A microscopic examination of the worms forwarded by Doctor Gates showed them to contain calcareous corpuscles, hence the diagnosis of cestode infection was immediately established in this case on the same basis as was the diagnosis in the Japanese case. The cestode in question is a larval form, without suckers on the head, and, as far as seen, without any primordium of genital organs. The most striking feature of the worm is its irregular shape, with tendency to proliferation by forming supernumerary heads. These characters immediately bring up for consideration the question as to whether the worm found by Gates is identical with the parasite recently reported by Ijima (1905) for Japan. As the American and the Japanese parasites are very closely related, possibly specifically identical, it will be well to follow the two in comparison. In doing this it will be advisable to abstract Ijima's paper rather liberally, more especially since it is published in a journal not generally accessible to dermatologists.

The worm capsule of Ijima's parasite.—Ijima (1905, 4-5) states that the worm capsules of various sizes occur in abundance in all parts of the subcutaneous tissues and less abundantly in the corium. They were also observed in some numbers in the intermuscular connective tissue, but not in the muscles themselves, so far as such observation could be made on parts incidentally exposed during the surgical operation. In the corium the capsule may be situated so close to the epidermis that the latter is externally raised into an acnelike prominence. On a piece of the preserved skin about 2 inches square, Ijima found at least four such prominences, which, as seen on the surface, appear smooth and less pigmented than the surrounding parts. Capsules so superficially situated might easily be ruptured by force applied through the skin from without.

In shape the capsules are generally subspherical or ovoid. While the smallest of them are considerably less than 1 mm., others measuring 1 to 2 mm. or more are of quite common occurrence; one of the largest seen was elongate, 2.5 mm. broad by 8 mm. long; another measured 3 mm. by 6 mm. The larger capsules were found only in the subcutaneous parts, not in the corium.

The capsular wall, consisting of a dense felt work of connective tissue fibers of the host, may reach nearly 0.33 mm. in thickness; in sections the capsules may appear not unlike a transversely cut blood vessel on account of the tough and compact looking wall; under a hand lens the inner surface of the capsule appears smooth; in some of the larger cysts the internal cavity is traversed by branching trabeculae; microscopically the wall either shows no special limit-

ing structure, or is lined with a deposit of granular coagulum or tissue débris.

Abundance of parasite.—In Doctor Gates's letter of June 17 he states that his "patient has thousands of" these parasites.

In the Japanese case a section of about 11 sq. cm. showed nearly 60 capsules; in the most thickly infested portions of the thigh there was one capsule to every 20 sq. mm. of cut surface, or to every 100 cub. mm. of infested tissue; this gives 1,000 capsules per 100 cub. cm. of tissue. It was estimated that there must have been considerably over 10,000 capsules in the left thigh alone.

Worms without capsules.—Scarcely any of the worms Gates forwarded to me bore any remnant of the cyst. Very probably most of these specimens were originally encysted and were freed from their cyst by Doctor Gates before he forwarded them.

Comparatively young, slender worms were found by Ijima free in the connective tissue—that is, not surrounded by a capsule.—Ijima, 1905.

Movements of the worm.—Not having seen the worm alive, I can give no details regarding movements.

Ijima reports that the living worms when taken from the patient showed slow movements of extension and contraction, but effecting little or no change in position; upon cooling the worms no longer exhibited such movements; in case of worms placed in salt solution motion could be revived up to a period of four hours if the parasites were slightly warmed.

The head (narrow end) was the most motile, evaginating and invaginating at the apex, in addition to shortening and extending; the terminal, but inconstant, depression in some cases reminded the observer of a terminal sucker, such as seen in the fish bothriocephalid *Cyathocephalus*. In addition to a motion as if feeling about, the head started a lively peristalsis from before backward; such combined movements would aid the worm in penetrating and moving through tissues.

The broader parts of the body showed at most slow verniform movements, with more or less constant indentation at the extreme hind end.

The head.—Ijima states that the head of his parasite is devoid of any definitely formed or permanent organ of attachment. This holds true also for the worm found by Gates. In some few specimens a slight apical depression is observed, but as the material is preserved in alcohol this might possibly be either an artifact or a depression due to sudden contraction on the part of the worm.

Encysted worms.—Gates writes that he found as many as 3 worms in one cyst. This condition is doubtless due, as Ijima explains also for his case, to the tendency of the worm to multiply by budding.

Ijima reports that the smaller capsules usually contained only a single worm; in the larger cysts, however, 2 or more worms or pieces were more frequently found; from one capsule 5 worms were obtained, and from another 7 worms.

Size and shape.—The longest specimen I have observed is 12 mm. in length. Some of the worms are simple elongated bodies, either more or less flattened, or nearly round in transverse section. The larger specimens, however, assume all manner of bizarre and irregular shapes which can not be well described. These variations in form may be reduced to a progressive but irregular formation of buds, the apex of each bud representing a structure similar to the cephalic end of the original worm; the form varies, of course, according to the number, position, contraction, etc., of the buds, and according to the contraction of the parent stock. Figures 5 to 15 will give an idea of the great variety of forms found.

According to Ijima, many of the worms are small, filiform, about 0.3 mm. in diameter, 3 mm. in length; others attain, even when moderately contracted, 12 mm. long by 2.5 mm. broad. In some specimens the body is flattened dorsoventrally, but there is no clew as to which is the dorsal and which is the ventral surface. In its simplest form the worm is plerocercuslike, or narrow at the head and broader caudad when moderately contracted, or irregularly cylindrical when strongly contracted.

This simple plerocercuslike larva, when encysted, may assume a rather complicated structure, due to its ability to form buds or supernumerary heads, especially on the lateral edges of the flattened body in younger specimens, but quite irregularly in the more complicated older forms. When the heads detach themselves they represent small independent plerocercuslike larvæ, and their method of formation explains the presence of several worms in one cyst.

The formation of heads in the manner described naturally tends to give the worms a very irregular outline; this irregularity is increased by the formation of subcuticular bodies, which Ijima interprets as food material. Ijima assumes that these young heads leave the capsule and wander through the connective tissue until they grow in size, and then in turn form a capsule of their own.

Microscopic anatomy.—According to Ijima, the cuticle of the Japanese form may attain 8μ in thickness; the dermal musculature consists of external circular and internal longitudinal fibers. These statements are correct as applied to the Florida form also.

The *calcareous corpuscles* of the Japanese worm are described by Ijima as spherical or ellipsoidal, 7.5 to 12μ in diameter, and abundant in all parts of the parenchyma, except in the head, in which they are lacking. In the Florida form also the calcareous corpuscles are abundant; they vary in size from 8.8 to 17.6μ ; in shape they are

spherical to ellipsoidal. Thus, in reference to the size of the calcareous corpuscles, there seems to be a slight difference between the American and the Japanese parasites.

Reserve food bodies.—Ijima has described as present in the parenchyma certain bodies which he views as reserve food material. Usually they are roundish or oval, 100 to 300 μ in diameter; but they may become very elongate.

In the Florida parasite similar bodies are present, but in the specimens thus far examined microscopically they do not seem to be quite so numerous or quite so large and prominent as described by Ijima for the Japanese form. It is possible, however, that this is a matter of individual variation.

Excretory system.—The parasites, as described by Ijima, contain an extensive system of anastomosing excretory vessels. In this respect the Florida form agrees with the Japanese species. Some of the canals are quite large, others are smaller, some are very small. Ijima calls attention to the absence of excretory vessels in the peripheral zone of the posterior part of the body; he also states that he was unable to find any opening.

In sections of one of the Florida parasites fine canals were found rather close to the cuticle, but because of the branched condition of the worm it is difficult to state just what portion of the body this was; it was not, however, a head. Likewise, in one case sections of a pore (fig. 18) on the surface, with a centripetally directed canal, were distinctly seen. In view of the absence of genital organs one is naturally inclined to look upon this pore as belonging to the excretory system.

The longitudinal muscles of the Japanese worm are described as well developed, and in addition there is a less strongly developed set of muscle fibers running in different directions but mainly in the transverse plane. Near the head these transverse muscles may be quite regular (some dorsoventral, others crossing these at right angles), but in thicker portions of the body they may become very irregular. This description applies in a general way to the Florida form also.

Nervous system.—Ijima noticed a pair of longitudinal, lateral nerve trunks in the cephalic portion; they seemed to unite close to the tip of the head. In several sections of the Florida worms nerves were distinguished, but details as to their topography were not studied.

Life cycle.—Experiments to raise the adult stage by feeding the Japanese parasites to cats, dogs, and pigs were negative.

As all of my own material was preserved no experiments could be undertaken. The question as to the source of infection, life cycle, etc., must be left open for the present.

SYSTEMATIC POSITION.—From the general structure, especially from the presence of calcareous corpuscles, it is clear that both the Japanese and the Florida parasites are cestodes; the absence of suckers seems to place both forms in the old family Bothriocephalidae, now known as Dibothriocephalidae. Further than this, the exact systematic position is not clear at present and can not well be determined until the adult stage is known.

So far as can be judged from the material thus far studied (prior to the meeting of the International Dermatological Congress in New York, September 9, 1907), the Florida form must be considered as very closely allied to, perhaps specifically identical with, the Japanese form. The only anatomical point of difference thus far brought out is a difference in size of the calcareous corpuscles; the only biological difference known is the habitat—in two widely separated localities.

Ijima points out the structural affinities between the Japanese form and the bothriocephalid larval *Sparganum* of Diesing; he refers also to the similarity between the Japanese form and "*Ligula mansoni*" (= *Sparganum mansoni*).

Sparganum is an artificial collective group of worms, distinctly proposed, not as a systematic unit, but as a collective group of larval bothriocephalid cestodes. Under the International Code of Nomenclature (1907) such names may be proposed as a matter of convenience and may be used as if they were generic names; they do not require any type species and hence do not compete with generic names under the law of priority.

Both the Japanese and the American parasite may be temporarily classified in *Sparganum*.

The Japanese worm was originally published under the two names *Plerocercoides prolifer* and *Plerocercus prolifer*, but Ijima distinctly states that he uses the names as a matter of convenience, namely, not in a taxonomic sense. Certain objections arise, however, to the use of the names *Plerocercus* and *Plerocercoides* in this connection, and on this account I transferred (1906a) the parasite to *Sparganum*.

The nomenclatural points involved are somewhat complex and it may be well to explain them in this place.

Under the original international code, the names of larval cestodes and of certain other forms were, for special reasons, exempted from the law of priority. Later (1901), contrary to the judgment of helminthologists, this exemption was done away with.

To apply the law of priority consistently to all such larval names would be almost an impossibility. There are, in fact, many names which have been proposed, not in a generic sense, but as names of admittedly artificial groups, which were used simply as a matter of

temporary convenience, and it was on account of a failure to distinguish between names of this category and names proposed for supposed genera that the exception was rescinded. In 1907, at the Boston congress, a helminthologist proposed the following, which was adopted as part of the code:

"Certain biological groups which have been proposed distinctly as collective groups, not as systematic units, may be treated for convenience as if they were genera, but they require no type species. Examples: *Agamodistomum*, *Amphistomulum*, *Agamofilaria*, *Agamomermis*, *Sparganum*."

As will be shown below, *Plerocercus* and *Plerocercoides* also now come under this paragraph. As matters now stand it is necessary to show that a name was distinctly proposed to designate an artificial collective group in order to bring it under this provision. A name like *Cysticercus* or *Echinococcus*, originally proposed as generic, not distinctly to cover an admittedly artificial group, is subject, now as before, to the law of priority.

The term *Plerocercus* (πλήρης, full; κέρκος, tail) was proposed by Braun (1883a, 98) as designation for the parenchymatous cysticerci (namely those the caudal portion of which contains no fluid) as distinguished from the bladder worms, or true cysticerci; thus it is a descriptive term for a stage of development (larva) possessing certain characters, but not the designation, of a systematic unit. As examples, Braun cited a *Plerocercus* [*Dithyridium lacertæ* Val.] of lizards and a *Plerocercus* of *Tetrarhynchus*. This plerocercus of the lizards happens to figure in a true nomenclatural sense, namely in the genus—

DITHYRIDIDIUM Rudolphi, 1819.

1819: *Dithyridium* Rud., 1819a, 559 (*lacertæ viridis*, *lacertæ muralis*; Europe. Type by later absolute tautonymy *Picstocystis dithyridium* = *Dith. lacertæ*).

1850: *Picstocystis* Dies., 1850a, 478, 494-496 (*Dithyridium* 1819, renamed; includes as valid species *P. crispa* (Rud.), *P. rugosa* Dies., *P. variabilis* Dies., *P. dithyridium* Dies., [for *Dithyridium* of Rud., namely *D. lacertæ* Valenciennes, 1844]).

This genus is based upon a larval tapeworm (a plerocercus) provided with four suckers, and is classified in the family Taniidæ; the type species occurs in Europe in lizards of the genus *Lacerta*.

In 1866 Baillet mentioned a parenchymatous cysticercus (namely a plerocercus) from the abdominal cavity of the cat and the dog. In 1882 or 1883, Blumberg described this form as a new species under the name *Cysticercus elongatus*; the latter name however was already preoccupied (cf. *C. elongatus* Leuck., 1842). In 1885, Railliet renamed this form *Cysticercus bailleti*, and in 1893a, p. 314, he classi-

fied it in the genus *Dithyridium* as *D. elongatum*. In the meantime, however, Neumann (1892a, 537-539, figs. 292-293) referred to the same parasite as "*Plerocercoides bailleti*," clearly using a Latin binominal nomenclature. .

The name *Plerocercoides* as used by Neumann is traceable to Braun (1883a, 100) who used a German term ("Plerocercoiden") to designate certain larval forms which differed from the cysticercoids by having parenchymatous tails. As examples Braun cites a form which occurs in the body cavity of *Trichodectes canis*, and the young (*Gyporhynchus* of *Tenia macrocephala* and *T. unilateralis*. Blanchard (1888a, 491) used a French form (*Plérocercoides*) of the word, while Neumann (1892a, 537) seems to have first used the Latin *Plerocercoides*. From Neumann's text, however, it is clear that he based his name on Braun's "Plerocercoiden;" hence Neumann's *Plerocercoides* is not a generic name but the designation of an artificial collective group; hence also the type designation (*bailleti*) suggested by myself in 1906 is not necessary under the new (1907) code.

As a plerocercus may be the larval form of species belonging to widely distinct families, even to different orders, it is wise not to use the combination *Plerocercus prolifer* in case a better designation is available; this point probably occurred to Ijima, for he used the combination only once. *Plerocercoides* is also open to the same objection, and in the only use of the term prior to Ijima it was used for a *Dithyridium*.

It so happens that Diesing proposed a name which is open to fewer objections. This is the

Collective Group SPARGANUM Diesing, 1850.

DIAGNOSIS.—*Dibothriocephalids*: An artificial collective group to contain larval stages of bothriocephalid worms which have not reached a stage in their development that they can be determined generically.

Such groups do not require a type species.

In 1906 I placed Ijima's form in this group as

The Proliferating Japanese Tapeworm Larva—SPARGANUM PROLIFERUM (Ijima, 1905) Stiles, 1906.

SPECIFIC DIAGNOSIS.—*Sparganum*: Larva may attain 1 to 12 mm. in length and 2.5 mm. in breadth; head narrower and more motile than posterior end and may show an apical depression which, perhaps, serves as sucker; no true suckers or other organs of attachment present. Calcareous corpuscles spherical or ellipsoidal, 7.5 to 12 μ (Japanese worm) or 8.8 to 17.6 μ (Florida worm) in diameter, and situated in any part of body except head; irregularly distributed reserve food bodies present in older specimens, but they later undergo disintegration; genital organs not present; longitudinal muscles better developed than either dorsoventral or transverse system; transverse fibers do not

divide body into cortical and medullary layers; excretory system well developed, consisting of larger approximately longitudinal branches, with anastomoses. The larvæ possess the power of multiplying by transverse fission and of forming supernumerary heads which may become independent. Adult unknown.

HABITAT.—Encysted in subcutaneous tissue and elsewhere in man.

GEOGRAPHICAL DISTRIBUTION.—Found but twice; once by Ijima in Tokyo, Japan; once by Gates in Manatee, Fla.

Whatever results may be obtained from examination of further material, which I could not study prior to the meeting of this Dermatological Congress, at the present time I do not feel justified in separating the American form specifically from the Japanese species, despite the difference in geographic distribution and the slight difference in the calcareous corpuscles. That the adult stage may eventually prove the Florida form to represent a distinct species seems entirely possible; in fact, when we consider the seeming isolation of the two cases this appears probable. At the same time, if it should eventually be shown that the infection was contracted from eating marine fish, the possibility would not be excluded that the two forms are identical, despite the wide difference in locality. In the interest of conservatism, accordingly, I classify for the present the two in the same species.

In an earlier paper (1906a, 86) I called attention to the fact that because of the remarkable reproduction of the larval stage described by Ijima a new genus would probably be justified. I hesitated somewhat to make the genus without seeing actual specimens. After examining the American specimens I am further convinced of the probability that the worm in question represents a new genus.

The proposition of a new generic name at this time presents both advantages and disadvantages. To continue to call the worm *Sparganum* shows that the family position is recognized, but that the adult is unknown; the worm is, however, so different from the other forms of *Sparganum* that it seems advisable to bring out this difference in a generic name; further, as long as a new generic name seems almost inevitable, it would appear wise to introduce it as soon as possible, in order to reduce its competition (through homonymy) in the future. On the other hand, to introduce a new combination at present does not seem absolutely necessary; its introduction would destroy the advantages we have at present in the use of the name *Sparganum*.

There is, I believe, a conservative method by which the advantages of both plans may be united, namely, by the introduction of a new subgeneric name. This course permits the continuation of the use of the name *Sparganum*, and at the same time brings out the fact that the worm is very different from the other forms of *Sparganum*;

further, it procures for the name any advantages in homonymy which may be gained by its proposal this year instead of later.

As such subgeneric name I propose—

GATESIUS ^a n. subg.

DIAGNOSIS.—*Dibothriocephalida*,? *Ligulina*, classified temporarily in *Sparganum*: Adult unknown. Larva in its simplest form similar to the plerocercus of *Dibothriocephalus*, except for suckers, which are not indicated: possesses the property of branching and of reproducing by budding, thus forming supernumerary heads which become free from parent and assume the simple plerocercoid form. Body contains numerous calcareous corpuscles, richly developed canal system, and may contain reserve food bodies.

TYPE SPECIES.—*Sparganum* (*Gatesius*) *proliferum* (Ijima, 1905) Stiles, 1908, from connective tissue of man; Japan.

If will be noticed that from the form of this proposal the name *Gatesius* is proposed not as a collective group, similar to *Sparganum*, but as a true systematic name of subgeneric rank. When the adult form becomes known the species should be taken out of the group *Sparganum* and this subgenus raised to generic rank.

^a Dedicated to Dr. H. Gates, of Manatee, Fla., who found the first American case.

A REEXAMINATION OF THE TYPE SPECIMEN OF *FILARIA RESTIFORMIS* LEIDY, 1880,= *AGAMOMERMIS RESTIFORMIS*.

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(Figs. 19 to 26.)

While examining some specimens in the Army Medical Museum with the late Dr. James Carroll, I found Leidy's original specimen of *Filaria restiformis*, reported as a parasite of man. As the parasite has been reported but once, and as little is known regarding its nature, I requested Major Carroll to place the specimen at my disposal for study. This he kindly did.

HISTORICAL REVIEW.—Leidy (1880c; 1904a, 157-159) received from Dr. J. J. Woodward, U. S. Army, a specimen of a worm which had been sent to the Army Medical Museum, Washington, D. C., by Dr. C. L. Garnett, of Buffalo, Putnam County, W. Va., together with the following extract from a letter:

During the winter of 1876 a man, a common laborer, aged about 50, presented himself to me for treatment, having a gleety discharge from the urethra, with a burning sensation during and after micturition. Previously he had been treated for gonorrhœa, and I prescribed accordingly. The patient, not improving, applied to other practitioners. In April, 1878, he came to me with a round, vivid-red worm, 26 inches in length (the specimen you now possess), and very active in its movements, instantly coiling up like a watch-spring on being touched. Having no work on helminthology for reference, the only description I found which appeared to answer to the worm was that of *Strongylus gigas*, in Niemeyer, Vol. II, p. 47. The patient is an illiterate man, with no motive for deception. He informed me that he discovered the worm protruding from his penis and drew it out without pain or difficulty. He was in much agitation and alarm about the occurrence, fearing, as he said, that "there might be more behind that one." For a few days previous to its passage his urine was of a milky hue and some time subsequently of a yellow cast and slightly tinged with blood and mingled with mucus. The man is truthful, and no doubt exists in my mind or in the minds of his neighbors as to the correctness of his statements. I regret exceedingly that I did not appreciate the scientific interest of

the subject, and send you the specimen in a fresh state, but the busy routine of a country practitioner's life leaves no time for the study of other than subjects of practical value in one's everyday experience.

Leidy seems to have had some slight misgivings as to whether the worm actually represented a parasite of man, but he described it as a new species, with the following diagnosis:

Body long, restiform, nearly uniformly cylindrical, smooth, shining, elastic, tough, without evident annulation other than transverse wrinkling, with the anterior extremity evenly tapering in the continuous head, the end of which is rounded and smooth or without appendages of any kind: the posterior extremity not tapering, with the caudal end incurved, bluntly rounded, without appendages and imperforate or without evident anal or genital aperture. Mouth a terminal pore without lips, papillae, or armature of any kind. Pharynx cylindrical and opening into a straight cylindrical intestine, apparently ending in a blind pouch. Generative organs unobserved. Length of worm 26 inches, greatest thickness 1.5 mm. Width of head just behind the rounded extremity 0.375 mm., opposite the commencement of the intestine 0.625 mm., at the middle 1.5 mm., at the incurved caudal extremity 1.5 mm. Length of esophagus 1.125 mm.

Leidy adds that the worm is clearly neither a *Gordius* nor a *Mermis*.

Neither the figures nor the description as given by Leidy seem to be strongly confirmatory of the determination of *Filaria*. In fact, the description and the figure of the esophagus give rise to the question whether the worm may not belong to the *Mermithidae*, while the striation figured for the caudal end nearly establishes this point. Authors since 1880 have referred to *F. restiformis*, usually without expressing an opinion regarding the species, but Railliet (1893a, 530) and Penel (1905, 8) consider that it was probably a spurious parasite.

Bibliography.—1880: *Filaria restiformis* Leidy, 1880c, 130-132, figs. 1-2 (in *Homo*: West Virginia); 1904a, 157-159, 278.—R. Blanchard, 1890a, 13, fig. 390 a-b; 1895, 785.—Braun, 1883a, 184; 1895b, 227; 1903, 3 ed., 275.—Ijima, 1889b, 367.—Meniez, 1896, 359.—Penel, 1905, 8.—Railliet, 1893a, 530.—Stossich, 1897, 78.—Vaullegeard, 1901, 128.—Ward, 1895, 331; 1903, 704; 1903, 212.

REEXAMINATION OF TYPE.

Condition of material.—The worm is broken into several fragments and is not suitable to a detailed study. It was in alcohol when Doctor Carroll turned it over to me. It was next transferred to alcohol and glycerin; the alcohol was evaporated, and the fragments were studied in glycerin. Very few characters can be recognized, but sufficient was seen to exclude the worm from the genus *Filaria*.

General contour.—By placing the various fragments together figure 21 is obtained, showing the general appearance of the worm, natural size. It will be noticed that while the body is of nearly uniform diameter, the head is distinctly attenuated.

Cuticle.—The cuticle is about $32\ \mu$ thick on the anterior portion, $48\ \mu$ on the tail, and when focused sharply is seen to be composed of several concentric layers; this point is brought out clearly at the ends of the fragments and on transverse section. Sharp focus at high power shows in addition the distinct presence of a diagonal fiber system, such as is found in the *Mermithidæ*, and such as was clearly seen by Leidy and figured in his original publication.

Head.—The cephalic extremity is distinctly attenuated, as observed by Leidy, and then ends rather bluntly. The terminal mouth is very small, and without lips. Directly back of the mouth there are six papillæ, which can still be observed more or less distinctly. The presence of these papillæ definitely excludes the worm from the *Gordiidae*. Unfortunately it is impossible to roll the head, as it is somewhat compressed, apparently dorsoventrally. Two of the papillæ seem, however, to be anterior of the other four; it seems probable, therefore, that the former are lateral; the latter the submedian papillæ.

About $442\ \mu$ back of the mouth a structure was seen which bore some resemblance to an excretory pore with canal. If, however, the position of the papillæ is correctly interpreted, this excretorylike structure would be lateral, hence this can hardly be the excretory pore, but is more probably an artifact.

Tail.—The tail is curved ventrally and is bluntly rounded. No anus was discernible. In the body could be seen a dark cecal structure. Caudal papillæ were not observed. It would appear, accordingly, that the specimen is either a female or that it is immature.

Esophagus.—In describing the intestine Leidy says: "Pharynx cylindrical and opening into a straight cylindrical intestine, apparently ending in a blind pouch." This description immediately suggests the *Mermithidæ*. The only other group which would seem to come into consideration would be *Dracunculus*, which might be considered as a possibility on the assumption that the structures were to be interpreted similarly to Looss's 1905, fig. 39, p. 183, of *Dracunculus medinensis*. Such interpretation is not in harmony, however, with the diagonal fibers of the cuticle.

From the mouth a distinct cuticular tube, $17.6\ \mu$ to $26.4\ \mu$ in diameter, cuticle $8\ \mu$, lumen 9 to $10.4\ \mu$, can be traced for some little distance; this tube evidently represents the cuticular lining of the esophagus, and it is surrounded by a somewhat indistinct body, evidently the esophagus, about $130\ \mu$ in diameter.

At a point 0.88 mm. from the anterior extremity there is seen at one side of the esophageal cuticular lining a blind sack, directed cephalad, and apparently representing the fat body reported for the *Mermithidæ*.

Genital organs.—No genital organs can be discovered, so that the conclusion is drawn that the specimen is immature.

Cross section.—Advantage was taken of the fact that the specimen is in fragments to prepare transverse sections (fig. 26) of the end of one of the pieces. A careful histological study of the slides is precluded by the condition of the material. Nevertheless, some important anatomical observations are possible.

The cuticle consists of concentric layers. A subcuticula can also be distinguished more or less clearly. The muscles are divided into six fields, separated by the six longitudinal lines, but the finer structure of these lines can not be interpreted safely.

In view of the foregoing data it appears that *Filaria restiformis* should be transferred from the *Filariidæ* to the family *Mermithidæ*, as *Agamomermis restiformis*. Further, the idea that an error has occurred in interpreting this worm as a parasite of man seems to gain support, for it would be exceedingly difficult to explain the presence of a *Mermithidæ* in the bladder.

OBSERVATIONS ON TWO NEW PARASITIC TRÉMATODE WORMS: HOMALOGASTER PHILIPPINENSIS, AGAMODISTOMUM NANUS.

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Among the parasites recently sent to us for identification are two interesting trematodes which appear to be new species. One of them (*Homalogaster philippinensis*) is an amphistome from the Philippines, the other (*Agamodistomum nanus*) a distome from Africa.

Genus HOMALOGASTER Poirier, 1883.

1883: *Homalogaster* Poirier, 1883, 74-76, 79 (m. *paloniæ*); ὁμαλός, flat; γαστήρ, stomach; 1885, 120. For bibliography see Stiles and Hassall, 1908, Index Cat., Trematoda, Bull. 37, Hyg. Lab., U. S. P. H. & M. H. S.

GENERIC DIAGNOSIS.—*Paramphistomida*,² *Cladorchina*:^a Body divided into a large oval, anteriorly pointed, cephalic portion containing all of the inner organs, and a caudal portion composed of the large acetabulum. Dorsum convex. Venter flat or excavate, provided with alternating longitudinal rows of large mammalike structures; of these, the papillæ near the middle of the rows (both longitudinal and transverse) are larger than those further from the middle. Pharynx with two lateral pouches; esophagus present. Genital pore ventromedian, cephalad of testicles. Testicles in anterior half of body; ovary near acetabulum; vitellaria rather well developed, lateral of ceca, extending about from esophageal bifurcation to ovary. Egg with operculum.

HABITAT: Large intestine of ruminants.

TYPE SPECIES.—*Homalogaster paloniæ* Poirier, 1883.

Comparatively little work has been done on this genus. In fact, Fischæder was obliged to leave open certain questions in regard to the generic characters. With the new form here described, the genus contains three species. An effort to obtain the two known species for

^a In a later paper we shall have occasion to discuss the subfamily position of this genus.

purpose of comparison has not been successful. The three species in question may be distinguished by the following key and diagnoses:

KEY TO THE SPECIES OF HOMALOGASTER.

1. Testicles placed obliquely; oral papillæ not reported; genital pore near equator of esophagus; type locality, Java.....*H. paloniæ* (p. 24).
2. Testicles, one caudad of the other; oral papillæ present; genital pore at equator of esophagus; type locality, Manila, P. I.
H. philippinensis (p. 25).
3. Testicles on same transverse plane and divided into 2 large equal lobes, simulating 4 testicles; oral papillæ present; genital pore caudad of bifurcation of intestine; type locality, Tonkin.....*H. poirieri* (p. 24).

In view of the comparatively restricted knowledge of this genus it seems advisable to give our present data regarding the two species already described before passing to a discussion of the new form.

HOMALOGASTER PALONIÆ Poirier, 1883.

(Figs. 27 to 28.)

1883: *Homalogaster paloniæ* Poirier, 1883, 74-76, pl. 2, figs. 1a-b (cecum of *Palonia frontalis*; from Java).—For bibliography see Stiles and Hassall, 1908, Index Cat., Trematoda, Bull. 37, Hyg. Lab., U. S. P. H. & M. H. S.

SPECIFIC DIAGNOSIS.—*Homalogaster* (p. 23): Something over 12 mm. long; form lanceolate; anterior cephalic portion very pointed, 11 mm. long by 6 mm. in maximum breadth; caudal portion much shorter, 3 mm. in maximum breadth. Genital pore on center of a papilla 1.5 mm. from very small terminal mouth. Venter with alternating longitudinal rows of large papillæ extending from about 3 mm. from oral margin to acetabulum. Acetabulum 2 mm. in diameter. Oral papillæ are not reported. Esophagus bifurcates 3 mm. from mouth; intestinal ceca extend to end of anterior portion of body.

Male organs: Testicles small, placed obliquely in cephalic half of body between ceca; one slightly to the right of the median line and 4 mm. from oral margin; the other 2 mm. further caudad, slightly to the left of the median line.

Female organs: Ovary 9.5 mm. from oral margin; vitellogene glands ramified, along the sides of body; uterus almost without coils. Excretory pore dorsal, 12 mm. from mouth; excretory vesicle with 2 lateral lobes.—Based on Poirier, 1883, 74-76.

HABITAT.—In cecum of "*Palonia frontalis*," from Java.

HOMALOGASTER POIRIERI Giard and Billet, 1892.

1892: *Homalogaster poirieri* Giard and Billet, 1892a, 615 (large intestine of cattle; Tonkin).—For bibliography see Stiles and Hassall, 1908, Index Cat., Trematoda, Bull. 37, Hyg. Lab., U. S. P. H. & M. H. S.

SPECIFIC DIAGNOSIS.—*Homalogaster* (p. 23): Size not given. Mouth with slender digitate papillæ. Genital pore caudad of intestinal bifurcation, on elevated papilla, visible to naked eye, a little behind pharynx. Acetabulum very large. Pharynx followed by 2 long simple ceca, which extend in almost a straight line to nearly the latitude of acetabulum (?? indicating absence of esophagus). Vasa deferentia (deferentia) short, thick, tortuous; testicles lat-

eral (apparently meaning on same transverse plane), divided into 2 large equal lobes with sinuous margins, thus giving the appearance of 4 testicles occupying the corners of a square. Uterus with numerous slings, crowded together, and crowded with eggs in different stages of development; vitellaria lateral of intestinal ceca, with grapelike follicles; vitelline canals unite in posterior part of body, above (cephalad? or dorsad? of) acetabulum in the open space; ovary and shell gland near median line.—Based on Giard and Billet, 1892a, 615.

HABITAT.—Attached to mucosa of large intestine of cattle *Bos taurus*? or *B. taurus indicus*? at Tonkin.

Giard and Billet do not describe the form of the body, but state that it is different from that of *H. paloniæ*.

HOMALOGASTER PHILIPPINENSIS new species.

(Figs. 29 to 44.)

SPECIFIC DIAGNOSIS.—*Homalogaster* (p. 23): Body 7.5 to 9 mm. long by 4.5 to 5 mm. (or flattened to 7 mm.) broad, canoe shaped, cephalic extremity attenuated, caudal extremity rounded; when flattened, sides very convex; dorsum may show submedian longitudinal depressions. Genital pore 1 mm. from oral margin (about one-ninth to one-seventh of body length from mouth, and about at equator of esophagus) surrounded by depressed circular area bearing numerous small papillae. Venter with alternating longitudinal rows of large papillae extending from about 2 or 2.5 mm. from oral margin to acetabulum. Margins curved ventrally and are fairly sharp. Acetabulum about 2.5 by 2.7 to 3 mm. Esophagus extends to about one-fifth of body length from oral margin; intestinal ceca narrow, slightly tortuous, long, extending to acetabulum.

Male organs: Testicles lobate, in cephalic half of space between ceca; one caudad of the other; vesicula seminalis quite compactly coiled; pars muscularis distinctly but not highly developed; pars prostatica not prominent, may enlarge to quite a large diameter, thus resembling a "vesicula seminalis interna;" ductus ejaculatorius present; cirrus absent.

Female organs: Ovary and shell gland submedian, near end of one of the ceca, ovary cephalad of shell gland; vitellaria extend about from the bifurcation of esophagus to caudal plane of ovary; uterus with many coils, well developed, passes cephalad, dorsally of testicles, ventrally between vasa efferentia, ventrally of vas deferens, to pore; Laurer's canal opens dorsomedian at plane of termination of ceca. Genital papilla, when extruded, resembles human penis with glans; bears on its vertex a pore, from which runs the short ductus hermaphroditicus; when retracted the papilla resembles a partially inclosed cirrus pouch. Egg oval, operculated, with small knob at opposite pole; 125 to 139 μ by 67.5 to 86 μ .

Excretory pore dorsomedian about at equator of acetabulum.

HABITAT.—Cecum of *Bos* ———, at Manila, P. I. (type locality), and Phra-toom, Siam.

TYPE.—U. S. P. H. & M. H. S. 9580 (mounted); Cotypes 9581 and 9960.

Source of material.—This species has been sent to us on two occasions by Dr. Paul G. Woolley. The first specimens (U. S. P. H. & M. H. S. Nos. 9580 and 9581) were collected in 1904 from the cecum of two calves (*Bos* ———) at Manila, P. I.; the second sending (U.

S. P. H. & M. H. S. No. 9960) was collected from the small intestine of a cow (*Bos*——). Sept. 28, 1906, at Phrapatoom, Siam. No difference has been noticed between the Philippine and the Siam specimens.

EXTERNAL CHARACTERS.

SIZE.—The specimens vary from 7.5 to 9.5 mm. in length, and from 4.5 to 5 mm. in maximum breadth: may flatten under pressure to 7 mm. broad.

COLOR.—Alcohol specimens are of a grayish buff color.

FORM.—In form the fixed specimens are canoe shaped with an attenuated oral and a rounded caudal extremity. The body is divisible into a posterior somewhat cylindrical portion, forming about one-fourth of the total length and an anterior somewhat lancet-shaped portion forming the remaining three-fourths. The posterior cylindrical portion is slightly flattened on its ventral aspect on which it bears the aperture of the acetabulum. The anterior three-fourths of the body is arched dorsally and excavated ventrally. The dorsum may show two longitudinal depressions just mediad of the intestinal ceca. In some of the specimens the lateral margins have curled ventrad in a scroll-like fashion, but it is possible to flatten the specimens without breaking the margins.

SURFACE.—The surface of the rounded posterior portion is smooth: that of the anterior portion is smooth dorsally (without spines or papillæ), but ventrally it is provided with two sets of dissimilar papillæ. One of these sets consists of numerous small papillæ covering a circumscribed, slightly depressed area around the base of the genital papilla; when the genital papilla is not extruded, the genital pore is still in the center of a mammalike elevation (fig. 41), which is much larger than the circumgenital papillæ just mentioned, and which is separated (in sagittal sections) about 1 mm. from the oral margin. The other set of papillæ consists of large and quite prominent elevations arranged in parallel longitudinal rows, extending from about 2 to 2.5 mm. from the oral margin to the rounded caudal portion of the body; laterally they do not attain quite the margins of the body; the papillæ near the median line are the largest, those near the lateral margins are smaller; further, the most anterior and the most posterior of the papillæ incline to a smaller size; in their arrangement the papillæ of any given longitudinal row are situated more or less regularly to correspond to the spaces between the papillæ of the next longitudinal row: as a result, they appear not only in longitudinal, but also in diagonal rows.

The venter and dorsum meet laterally in fairly sharp margins.

Genital pore.—As indicated above, the genital pore (figs. 31 and 41) is ventromedian about 1 mm. from the oral margin, namely,

about one-ninth to one-seventh of the length of the worm from the oral margin.

Acetabulum.—Measurements of the acetabulum taken from press preparations make it about 2.6 mm. in longitudinal diameter by 2.75 to 3 mm. in transverse diameter. The aperture is rather oval in outline, about 1.55 mm. in transverse by 1 mm. in longitudinal diameter.

INTERNAL ANATOMY.

DIGESTIVE TRACT.—The anterior bluntly pointed, attenuated extremity (cephalic cone) is pierced by the mouth, which is not provided with a true sucker. The oral margin is surrounded by a number of slender, digitate papillæ. The mouth gives entrance to a muscular pharynx; the lumen of the latter is at first more or less circular in transverse section, but it rapidly becomes flattened and crescentic with the convexity of the crescent dorsad. From the horns of this crescent spring two lateral pouches and the lumen of the pharynx terminates blindly as a narrow crescentic slit connecting the two lateral pouches. From the ventral aspect and a little above the blind, slitlike termination of the lumen of the pharynx, the esophagus rises and passes caudad, forming a ventral curve in its course. At its point of origin it communicates laterally with the lumen of the pharyngeal pouches, between and a little ventrad of which it lies. The relation of the esophagus to the pharyngeal pouches and blind slit will be seen by reference to figures 32 to 36.

At about one-fifth of the total body length from the oral margin of the worm, the esophagus divides into two simple cecal tubes which pass at first laterocaudad, then in slightly tortuous line caudad to about the level of the cephalic margin of the acetabulum. Just before reaching their termination they shift a little toward the median line. One tube may be somewhat longer, and so terminate at a slightly lower level (more distal) than the other. In their course they are wavy and are separated by a distance about equal to that which separates them from the corresponding lateral margins of the worm. The pharynx, pharyngeal pouches, and esophagus are lined by a cuticle in anatomical continuation with that of the surface. At the esophageal fork this lining abruptly ceases, the intestinal tubes being lined by a nucleated epithelium.

GENITAL SYSTEM.—*Male organs:* The two testicles lie in the cephalic half of the area included between the intestinal ceca, and are somewhat nearer the dorsal than the ventral surface. (Fig. 31.) One is directly caudad of the other, the two being separated by a narrow interval which is partially occupied by some coils of the uterus. The anterior testicle is somewhat smaller than the posterior and in press preparations their outlines are sinuous, but sections

show them to be so markedly indented as to amount to a very distinct lobation. A vas efferens rises from each testicle; that from the posterior testicle appears to spring from the right dorsolateral aspect and passes cephalad between the anterior testicle and the right intestinal cecum; that from the anterior testicle springs from near the left margin of its cephalic aspect, and passing cephalad, it unites with its fellow beneath the esophageal fork to form the vas deferens. In their course they both become dilated and contain masses of spermatozoa. The vas deferens winds its way cephalo-ventrad in close relation with the coils of the uterus, and opens to the exterior by a pore common with the opening of the female duct. During its course, several distinct portions may be more or less clearly recognized, but not with equal ease in all specimens. Most favorable for interpretation seem to be specimens with fully extruded, mushroom-like genital papilla. The centripetal portion of the vas represents the vesicula seminalis, which is coiled up into a more or less compact mass and which, when filled with spermatozoa, may present quite a large lumen. Next, centrifugally, comes the pars muscularis; this is provided with distinct muscular fibers, but is not developed to such an extent as seen in certain other amphistomes, for instance in *Paramphistomum calicophorum*. The duct then becomes rather suddenly enlarged, is surrounded by a less prominent layer of muscular tissue, is provided with a considerable number of cells resembling those found in the pars prostatica of other amphistomes, but much less striking in their development and arrangement, so that were it not for analogy, one would probably hesitate to interpret them as prostatic cells; the lumen of this portion may contain large masses of spermatozoa, so that in general effect the structure reminds the observer of the vesicula seminalis interna described for certain species possessing a cirrus pouch. As this portion narrows centrifugally, the prostatic-like cells at first seem to increase, then to decrease in number, until they finally disappear. Then follows a portion of the male canal, of narrower diameter, but still remaining larger than the corresponding portion of the female duct, and apparently devoid of both muscles and prostatic cells; this apparently represents the ductus ejaculatorius and opens into such a short ductus hermaphroditicus that the latter almost represents only a pore common to the male and the female canals.

Female organs: Caudad of the testicles, the interspace between the intestinal ceca contains coils of the uterus, the ovary, and the shell gland. The ovary is a somewhat globular body, very much smaller than either testicle; it is placed a little to the left of the median line, near the end of one of the intestinal ceca, and somewhat above (cephalad of) the anterior margin of the acetabulum. From its dorsoinferior (caudal) aspect springs the oviduct which curves cau-

dad to enter the shell gland; the latter is immediately beneath (caudad of) the ovary. In the shell gland the oviduct unites with the vitellogen. Just before entering the shell gland the oviduct receives Laurer's canal, from which point the latter passes centrodorsad to open in the median line on the dorsal surface about on the transverse plane of the termination of the intestinal ceca.

From the ventral aspect of the shell gland and appearing like a continuation of a spindle shaped dilatation (ootyp) of the canal formed by the vitello- and oviduct there emerges the uterus which at once forms numerous coils. In its course cephalad the uterus passes dorsad of the testicles; a loop of it is tucked into the narrow interspace between the two testicles. Cephalad of the anterior testicle it winds its way ventrad to the genital pore, passing caudad of the arch formed by the union of the two vasa efferentia, and remaining in close relation to the ventral aspect of the male canal.

In its course the uterus contains numerous eggs and near its point of emergence from the shell gland some of the eggs are intermingled with a mass of spermatozoa.

The vitellogene glands lie in the lateral areas, beginning at the level of the esophageal fork and extending to a plane slightly caudad of the ovary. These vitellaria are composed of scattered irregularly globular follicles confined to the inner half of these areas. Somewhat above (cephalad of) the level of the ovary the main right and left vitellogens originate and pass mediad and slightly caudad in front (ventrally) of the intestinal tubes, to unite and form a common duct which curves around the caudal aspect of the shell gland, which it pierces to unite with the oviduct.

Genital pore.—The genital pore is situated at a point about midway from the oral margin to the esophageal fork, namely, about one-ninth to one-seventh of the body length from the oral margin. It is at the summit of a very peculiar genital papilla, which is easily subject to misinterpretation because of its different appearance in different specimens, due to the greater or less condition of extrusion or retraction. Sections with fully extruded papilla (figs. 31 and 37) form the best basis for study. When fully extruded, this papilla resembles somewhat the human penis with its glans. There is a distinctly swollen terminal portion 0.4 mm. in diameter, and 0.2 mm. long; this is followed centripetally by a constricted peduncle about 0.25 mm. in diameter and 0.15 mm. in length; its surface is smooth. At its vertex is situated the genital pore (opening of the ductus hermaphroditicus) from which the genital canals lead centripetally in quite a direct course. The parenchyma of this papilla is composed chiefly of very striking, large cells, provided with disproportionately small nuclei.

When the bulbous portion of this papilla is retracted (fig. 41) the large parenchymatic cells assume a rather deep position and might easily be interpreted as glandular cells: further, the retracting muscles arrange themselves in such a way as to give to the structure a remarkable resemblance to a partially formed cirrus pouch such as is described by Looss (1896b, p. 28, fig. 14) for *Gastrodiscus aegyptiacus*.

Egg.—The uterine egg (fig. 44) is oval in form and white in color by reflected light under a low power. With a slightly higher magnification by transmitted light it is seen to contain a dark, granular mass, with a circular area, somewhat eccentrically placed; this appears almost free of these dark granules; with still higher magnification it is noted that the eggshell is rather thin in the equatorial zone, but slightly thicker at the poles. At one pole the shell is provided with a small operculum; at the other pole, which at first appears to be somewhat less blunt, but which in reality is slightly more so, there is a small knob. The contents of the egg are inclosed in a membrane which with a high magnification does not appear to be in direct contact with the shell. The average measurements of 27 eggs were $132.2\ \mu$ in length, by $74.5\ \mu$ in width; the extremes were $125\ \mu$ and $139\ \mu$ in length and $67.5\ \mu$ and $86\ \mu$ in breadth.

EXCRETORY SYSTEM.—The excretory vesicle is situated dorsad of the acetabulum in the caudal rounded portion of the body. A little caudad of the cecal ends of the intestinal tubes it receives two large lateral excretory canals, which can be traced some distance cephalad. From the vesicle a canal passes caudodorsad to open in the median line of the dorsum about at the level of the center of the acetabulum. The canal is lined by a cuticle in anatomical continuation with that of the surface.

AGAMODISTOMUM NANUS new species.

(Figs. 45 to 66.)

SPECIFIC DIAGNOSIS.—*Agamodistomum*: Minute distomes 0.35 to 0.412 mm. long, 0.246 to 0.27 mm. broad, 0.147 mm. thick; oval, venter flat, dorsum convex, cephalic and caudal margins bluntly rounded, lateral margin convex. Apparently without spines. Oral sucker subterminal, $32\ \mu$. Acetabulum slightly larger, 41 to $46\ \mu$, in equatorial plane of body. Genital pore median, about midway between acetabulum and caudal margin (compare *Clinostomum*). Pharynx apparently present; postpharyngeal esophagus very short or wanting; bifurcation $92\ \mu$ from center of mouth; ceca fusiform extending beyond genital pore, may extend nearly to caudal margin. Primordium of cirrus pouch (?) large and prominent, extending nearly straight dorsad, between ceca; one genital primordium dorsocaudad of this, another caudad, near caudal margin. Excretory pore dorsosubterminal; primordium of excretory vesicle present; at least two excretory canals present.

HABITAT.—Embryoned in pectoral muscle of African partridge (*Francolinus subtorquatus*) at Benguela, West Africa.

TYPE.—U. S. P. H. & M. H. S., No. 9834, two worms mounted in toto on one slide; cotypes in sections. Alcohol material in U. S. National Museum and in collection of American Society of Tropical Medicine.

SOURCE OF MATERIAL.—A bottle of material collected by Doctor Wellman in Benguela, West Africa, and sent to us for determination, contained portions of the "pectoral muscles of a partridge, *Francolinus subtorquatus*." The muscles are beset with a number of small cysts, about 1.0 mm. long, which bear a superficial resemblance to the sarcosporidia occasionally found in birds. Upon careful teasing, as well as upon section, the cysts are seen to contain minute agamic distomes, apparently one parasite in each cyst.

SIGNIFICANCE OF INFECTION FROM STANDPOINT OF FOOD INSPECTION.—As will be seen from the following account of the anatomy, this parasite does not correspond to any species thus far known to occur in man. Whether it would develop in man further if taken in the food can not be stated at present. From the standpoint of food inspection the infection would for the present be similar to a severe infection with sarcosporidia, namely, an infection not dangerous to man, but one which so altered the condition of the meat as to lead to its condemnation.

At the present moment this infection is not known for partridges in the United States.

EXTERNAL CHARACTERS.

MEASUREMENTS.—The parasites vary in size, attaining 0.352 to 0.416 mm. in length by 0.246 to 0.272 mm. in transverse diameter, and 0.147 mm. in dorsoventral diameter.

COLOR.—The unstained alcoholic specimens are of a yellowish gray color, with two longitudinal lighter fusiform spots, due to the intestinal ceca. In transmitted light the worm has the appearance of a small amount of foam, this foamy appearance being due to the cellular structure.

FORM.—The worms are oval in outline, with flat venter and convex dorsum; the oral (cephalic) and aboral (caudal) margins are bluntly rounded and of nearly the same form; the lateral longitudinal margins are convex.

SURFACE.—No spines could be distinguished on the cuticle.

ORAL SUCKER.—The oral sucker is ventrosubterminal, 32.2 μ in diameter, and directed from dorsocaudal to ventrocephalad.

VENTRAL ACETABULUM.—The ventral acetabulum may be exactly in the equatorial plane, or slightly caudad of equator: it is 41 to 46 μ in diameter, with a circular aperture of 13.8 μ ; on section it is 38.8 μ in dorsoventral diameter.

GENITAL PORE.—Halfway between the acetabulum and the caudal

margin, or slightly nearer the acetabulum, is situated the genital pore, which is rather prominent and is surrounded by darkly staining tissue.

EXCRETORY PORE.—The excretory pore is dorsoterminal.

INTERNAL ANATOMY.

DIGESTIVE TRACT.—The digestive tract is the most prominently developed organ system in this stage of development. Through its entire extent its lumen is entirely occupied by a gelatinous or (?) granular mass, in which cellular structure is not distinguishable.

Extending dorsocaudad from the oral sucker the esophagus may be distinguished; at the point where the esophagus leaves this sucker there is a bulbous structure, the wall of which is composed of a single row of nucleated cells; the impression gained is that this is a pharynx in process of development. The bifurcation (into two intestinal ceca) occurs about $56\ \mu$ caudad of the center of the oral sucker, so that the postpharyngeal portion of the esophagus, though distinct, is exceedingly short. In their course caudad the intestinal ceca diverge from the median line and at first, for a distance of about $92\ \mu$, increase gradually in diameter; then they increase rapidly in diameter, but upon nearing the region of the genital pore they again decrease, each ending in a rather sharp point somewhat caudad of the pore; in some cases they extend to a plane about halfway between the genital pore and the caudal end of the body. In transverse section the ceca are nearly circular, but the dorsoventral diameter is slightly greater than the transverse diameter (88 to $76\ \mu$ in one case). Thus the ceca represent the two fusiform spots seen in the unstained specimen.

In the wall of the ceca may be seen a few very small nuclei.

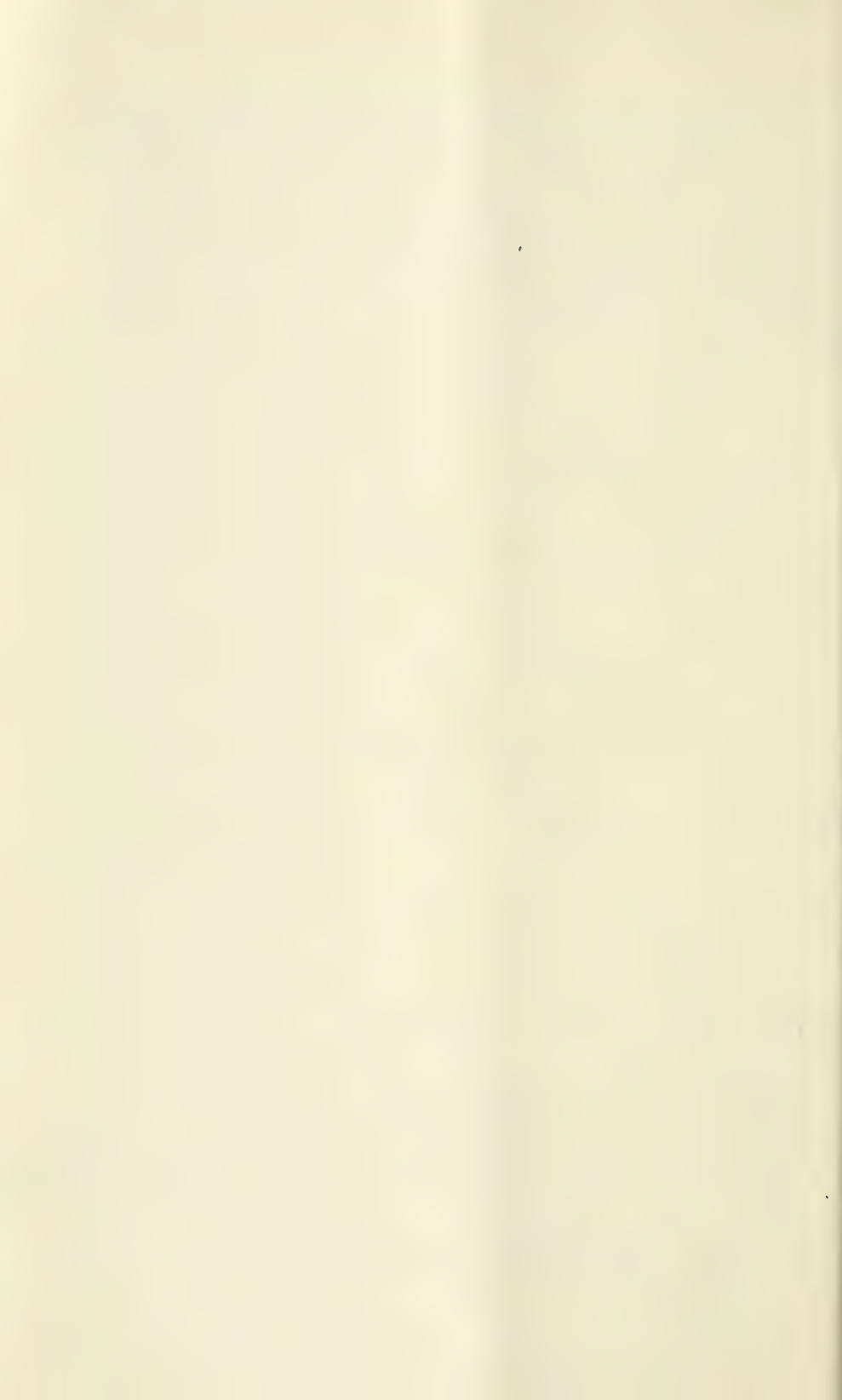
The ceca are somewhat nearer the dorsum than the venter.

GENITAL SYSTEM.—The primordium of the genital system is present, but the arrangement of the sexual glands can not be analyzed. On section a distinct canal is seen, to run almost directly dorsad, but slightly caudad, between the intestinal ceca; in one section this canal had the appearance of dividing into two canals, a male and a female duct, but this point can not be asserted without reserve. The canal is surrounded by a mass of darkly staining tissue, about $69\ \mu$ long (i. e., dorsoventrad in reference to the worm) by $46\ \mu$ broad (cephalocaudad in reference to the worm); the entire structure gives the impression of being a cirrus pouch in course of development.

Dorsocaudad of this structure is a second, much smaller, darkly staining mass of cells, and still further caudad, near the caudal margin of the worm, is still a third darkly staining mass.

EXCRETORY SYSTEM.—At the caudal end, slightly dorsad, is an invagination, surrounded by a row of cells, and apparently representing the excretory vesicle. Excretory canals are also visible on section.

SYSTEMATIC POSITION.—From the foregoing account it will be seen that this worm is an agamic distome with genital pore about midway between the acetabulum and the caudal margin (compare for instance *Clinostomum*).



A REEXAMINATION OF THE ORIGINAL SPECIMEN OF *TÆNIA SAGINATA ABIETINA* (WEINLAND, 1858).

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Chief of Division of Zoology,
and

JOSEPH GOLDBERGER, M. D.,

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Hospital Service.

Since 1858 works on zoology and on the practice of medicine make mention of a tapeworm which Weinland described as *Tænia solium* var. *abietina*. Opinions of authors have differed in regard to the exact status of the parasite in question, some writers considering that it represented a distinct species, others that it was a variety of *Tænia solium*, and still others, that it was a peculiar specimen of *Tænia saginata*.

In a recent visit to Boston one of us found the original specimen, or rather all that seems to be left of it, in the Warren Anatomical Museum, and through the courtesy of Doctor Whitney, curator of the museum, we have been able to reexamine this interesting material. In connection with a brief account of our rather unsatisfactory results it may be well to give a review of the history of the parasite in question, which now bears the U. S. P. H. & M. H. S. No. 9713, but which will be returned to the Warren Museum.

SYNONYMY.

- 1858: *Tænia solium* var. *abietina* Weinland, 1858, 43-45, 84; 1861, 4-5, 12-14, pl. 5, figs. 18-20.
— as variety of *Tænia mediocanellata* in Leuckart, 1863, 289, fig. 80 (based upon reexamination of original material).—Diesing, 1864a, 369.
— as variety of *T. saginata* in Leuckart, 1880, 605-606, fig. 272.—Blanchard, 1886a, 362-363, fig. 238.
— as syn. of *T. saginata* in Braun, 1903, 3 ed., 224.
— as possible syn. of *T. confusa* in Braun, 1903, 3 ed., 229.
— as doubtful syn. of *T. saginata* in Stiles, 1898a, 72.
1864: *Tænia mediocanellata* var. *abietina* (Weinland, 1858) Diesing, 1864a, 369.
1873: *Tænia abietina* (Weinland, 1858) Davaine, 1873a, 572; 1877a, 1, 909, 910, 920.—Cobbold, 18—, —. —Swart, 1862, 18.
— as doubtful syn. of *T. saginata* in Stiles, 1898a, 72.

- 1880: *Tania saginata* var. *abietina* (Weinland, 1858) Leuckart, 1880, 605-606 fig. 272.—Stiles, 1906, June, 31-32, figs. 35-38.
 1885: *Tania abietina* (Weinland, 1858) Guzzardi Osmundo, 1885a, 580.

HISTORICAL REVIEW: Weinland's (1858, 43-45, 84) original account of this species is as follows:

[p. 43] § 63. Under this name [*Tania solium* var. *abietina*] I will introduce a specimen of tapeworm which comes from a Chippewa Indian, at the Sault Ste. Marie, Lake Superior: it was obtained there by Professor Agassiz during his famous trip to that lake. The specimen consists of a chain [p. 44] of several feet in length, from the mature part of the worm. The head, neck, and the whole anterior half are wanting.

The most striking thing in this worm is its extreme narrowness and meagerness, while *Tania mediocanellata*, which it resembles in the configuration of the uterus, is very broad and thick, according to Kuechenmeister. A figure of this worm, of its uterus and eggs, we intend to publish in our work on the parasites of man.

All the joints which are preserved are very thin, nearly transparent, and equally narrow, their transverse diameter being about 4 mm., and the longitudinal about 12 mm. The genital openings are very small, and without external lips; this may be owing to the very mature age of the joints in question. There is no pigment in either vagina or spermatheca. The uterus is more regular than either in *Tania solium* or in *Tania mediocanellata*, yet it more resembles the latter. The middle trunk of the uterus is quite straight; the branches, about 30 in number, start from the main stem, either at right angles or at an angle of about 45°. These branches are always quite parallel, and are generally straight; but whenever they are bent, all make the same angle; they are never arborescently divided, nor furcated at the ends, with the exception of the foremost and the hindmost in each joint, which run, the former forwards, the latter backwards, both being forked and crooked. The eggs, which are extremely plenty in these joints, and which show the whole configuration of the uterus in a yellowish tint to the naked eye, are 0.033 mm. long, and 0.030 mm. broad; they are protected, first, by an outside shell (chorion) which is 0.003 mm. thick, dark in its outer layers, transparent, yellowish inwards; then follows a second shell (yolk membrane), 0.0006 mm. thick, entirely transparent. In the cavity of the egg lies the embryo, occupying about two-thirds of it, and measuring only 0.016 mm. We saw other eggs, unripe, and with one eggshell only, but very rarely.

We consider this worm merely as a variety of *Tania solium*, and we called it varietas *abietina*, from abies, a pine tree, which the configuration of its uterus resembles.

We hope soon to get more information concerning this Indian tapeworm from our western and Canadian medical friends.

[p. 84] 2b. *Tania solium*, L. Varietas *abietina* Weinland.

Obtained by Prof. L. Agassiz from a North American (Chippewa) Indian, at Lake Superior. The specimen is preserved in the Zoological Museum, Cambridge, Mass.

Later, Weinland (1861, 4-5, 12-14, pl. 5, figs. 18-20) reverts to this subject; his account of the parasite is practically a translation of the paragraph quoted above, but he adds that the worm was collected in 1850; the eggs measure 33 by 30 to 33 μ ; the chorion is dark brown externally, lighter internally. Weinland was unable to recognize any further details.

So far as we have been able to find, Leuckart (1863, 289, fig. 80) is the only other helminthologist who has examined this parasite: he reexamined part of Weinland's original material and concluded that it represented a variety of *Tenia mediocanellata*; in his later work (1880, 605-606, fig. 272) he refers to it as *Tenia saginata* var. *abietina*. Not altogether in harmony with Weinland's description. Leuckart's figure of the uterus shows a number of the lateral pouches of the uterus as branched; he gives about 40 branches each side.

All later references to the parasite are either based directly upon the conclusions drawn by Weinland and by Leuckart, or are opinions expressed on basis of the data given by these two authors.

Diesing (1864a, 369) considers *abietina* a variety of *T. saginata*.

Blanchard (1886a, 362-363, fig. 238) considers it as "a simple variety of *T. saginata*."

Braun (1903, 3 ed., 224) thinks it a "*T. saginata*, with uterine branches somewhat more thickly set;" he also suggests (p. 229) that it may possibly be identical with *T. confusa* Ward.

Stiles (1906, June, 31-32, figs. 35-38) recognized the form provisionally as a subspecies of *Tenia saginata*. He republished Weinland's and Leuckart's illustrations of the worm.

REEXAMINATION OF ORIGINAL MATERIAL.—*Segments*: The specimen consists of only 5 gravid segments, which are in very poor state of preservation. At the time it came into our hands it was completely dried out and, naturally, brittle. It was soaked in very weak alcohol, which was gradually increased in strength; then it was transferred to alcohol glycerin, the alcohol was allowed to evaporate, and the worm eventually mounted in glycerin jelly. Because of its having been dried a detailed study of the anatomy is of course excluded.

The segments measure as follows:

About 12 mm. long by about 2 mm. broad.

About 12 mm. long by about 2 to 3 mm. broad.

About 12 mm. long by about 2 to 2.5 mm. broad.

About 11 mm. long by about 2.5 mm. broad.

About 11 mm. long by about 2.5 to 3.5 mm. broad.

Genital pores.—The genital pores are irregularly alternate and are caudad of the equator of the segment—more exactly, about five-eighths from the anterior margin.

Uterus.—No remnants of the genital glands can be seen, and it is scarcely possible to count the lateral branches of the uterus; these are, however, numerous.

Eggs.—The uterus is crowded with eggs, which vary in size from 31 to 37.5 by 30 to 33.9 μ . An average of 31 embryophores gave 36.27 by 32.09 μ ; the usual length (21 cases) was 37.5, the most frequent breadth (11 cases) 31.9 μ .

We have obtained or compiled the following measurements for the embryophores of the ténias of man:

- T. solium*, almost round, 31 to 36 μ .
T. saginata, ovoid, 35 to 40 by 20 to 30 μ .
T. confusa, 39 by 30 μ .
T. africana, 31 to 39 by 33.8 μ .
T. abietina, 31 to 37.5 by 30 to 33.9 μ .

From these measurements it will be seen that the eggs of *T. abietina* do not agree exactly with any of the species mentioned.

Calcareous corpuscles.—The calcareous corpuscles are exceedingly numerous, round to oval in shape, varying considerably in size, and attaining 17.6 μ in diameter. Comparing these with the measurements given for other forms, we have the following table:

- Tania solium*, up to 12 μ , sparse.
T. saginata, up to 18 μ , plentiful.
T. confusa, up to 11 μ , sparse.
T. africana, 10.4 by 16.9 μ , sparse.
T. hominis, very numerous.
T. abietina, up to 17.6 μ , very numerous.

The data given above are scarcely sufficient to enable one to express a positive opinion upon the systematic value of *T. abietina*. They seem, however, to be too meager to fully justify its separation from *T. saginata*, and almost too much to fully justify viewing it as a typical *T. saginata*.

Were these fragments sent to us for determination, without knowledge of their origin, we should conclude that they were probably a dwarfed specimen of *Tenia saginata*.

In order to obtain opinions from other persons, we have submitted the fragments to Hassall, Ransom, and Ward, requesting them to come to a conclusion before they inquired into the history of the material. Ward was disinclined to consider the segments as belonging to *T. saginata*, while Hassall and Ransom were both inclined to consider them as belonging to this species.

Under existing circumstances no exact determination can be accepted as final, but four of the five helminthologists who have re-examined the material incline to the *saginata* determination, while one is disinclined.

That the material does not agree exactly with the typical *Tania saginata*, as we find it in this country, must be admitted, but we do not feel justified at present in recognizing it as of full specific rank.

Under existing circumstances perhaps the best solution of the matter is to accept it as a doubtful subspecies, *Tania saginata abietina* and call attention to the worm in the hope that some new specimens may be collected which will permit of a definite opinion. We must look to the physicians in the North and West, particularly to those near Sault Ste. Marie, to find such material.

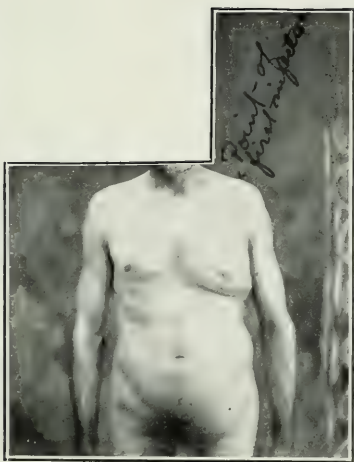


FIG. 1.

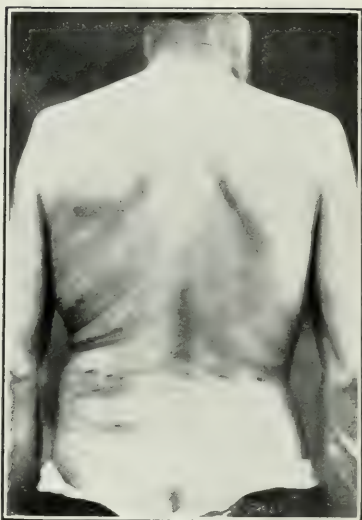


FIG. 2.



FIG. 3.

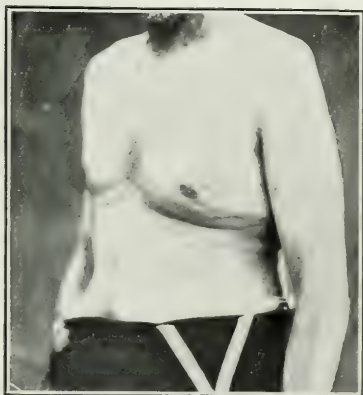
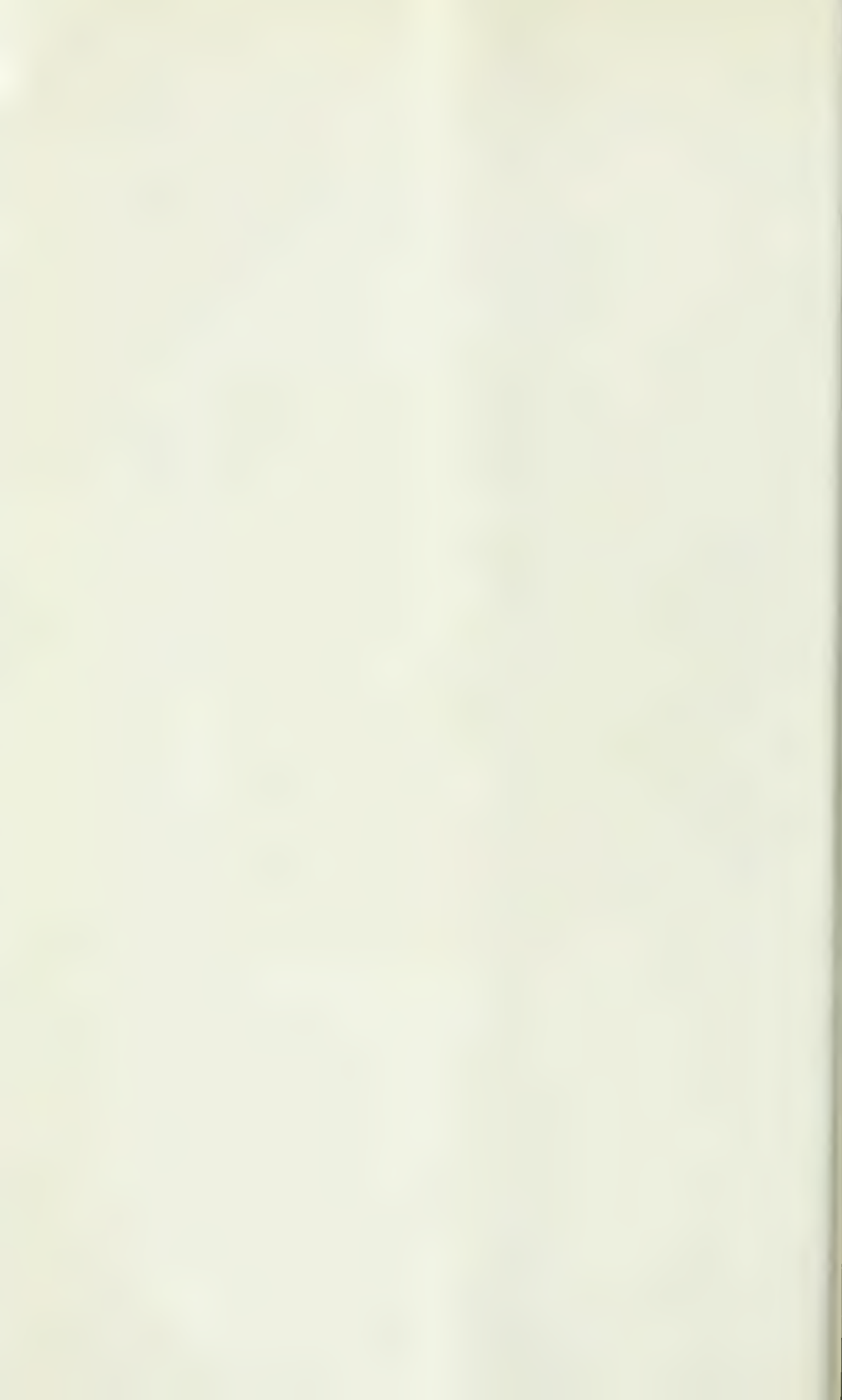


FIG. 4.

FIGS. 1-4.—Four photographs of Gates's patient in Florida, showing acne-like condition and enlarged breasts, due to infection with *Sparganium proliferum*. Original; photos kindly furnished by Doctor Gates.



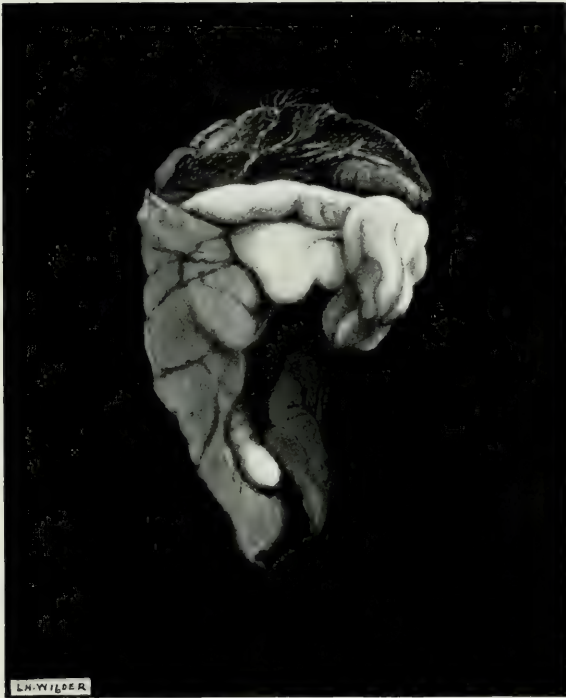
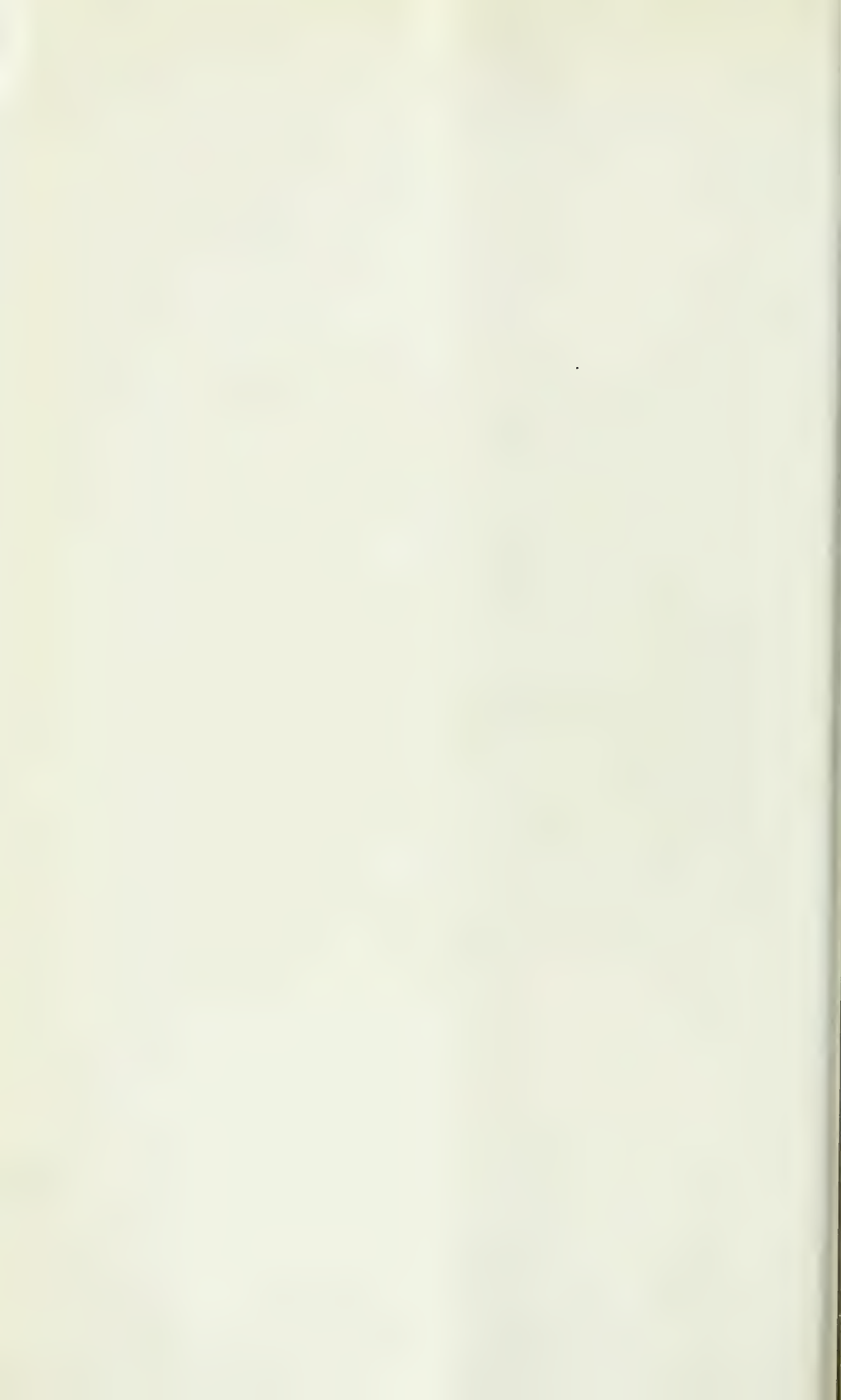


FIG. 5.—*Sparganum proliferum*, in part in a cyst. Original. $\times 10$.



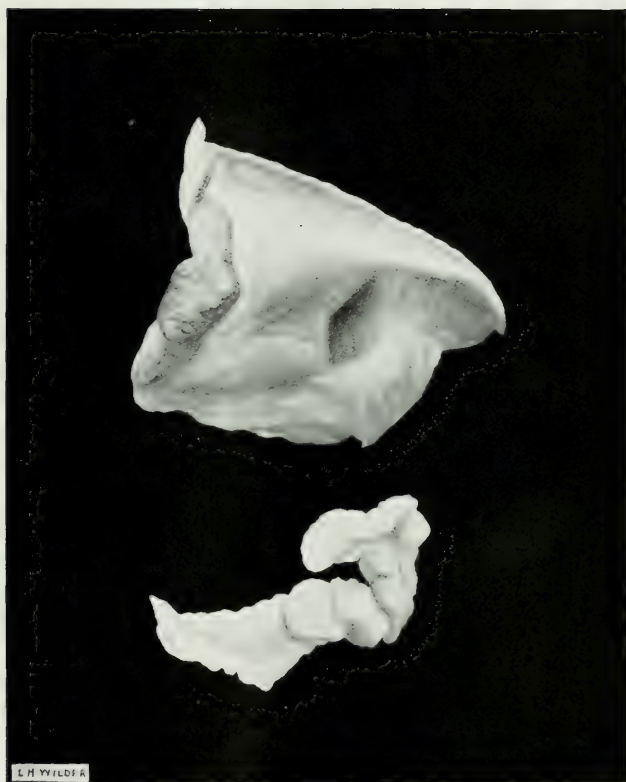
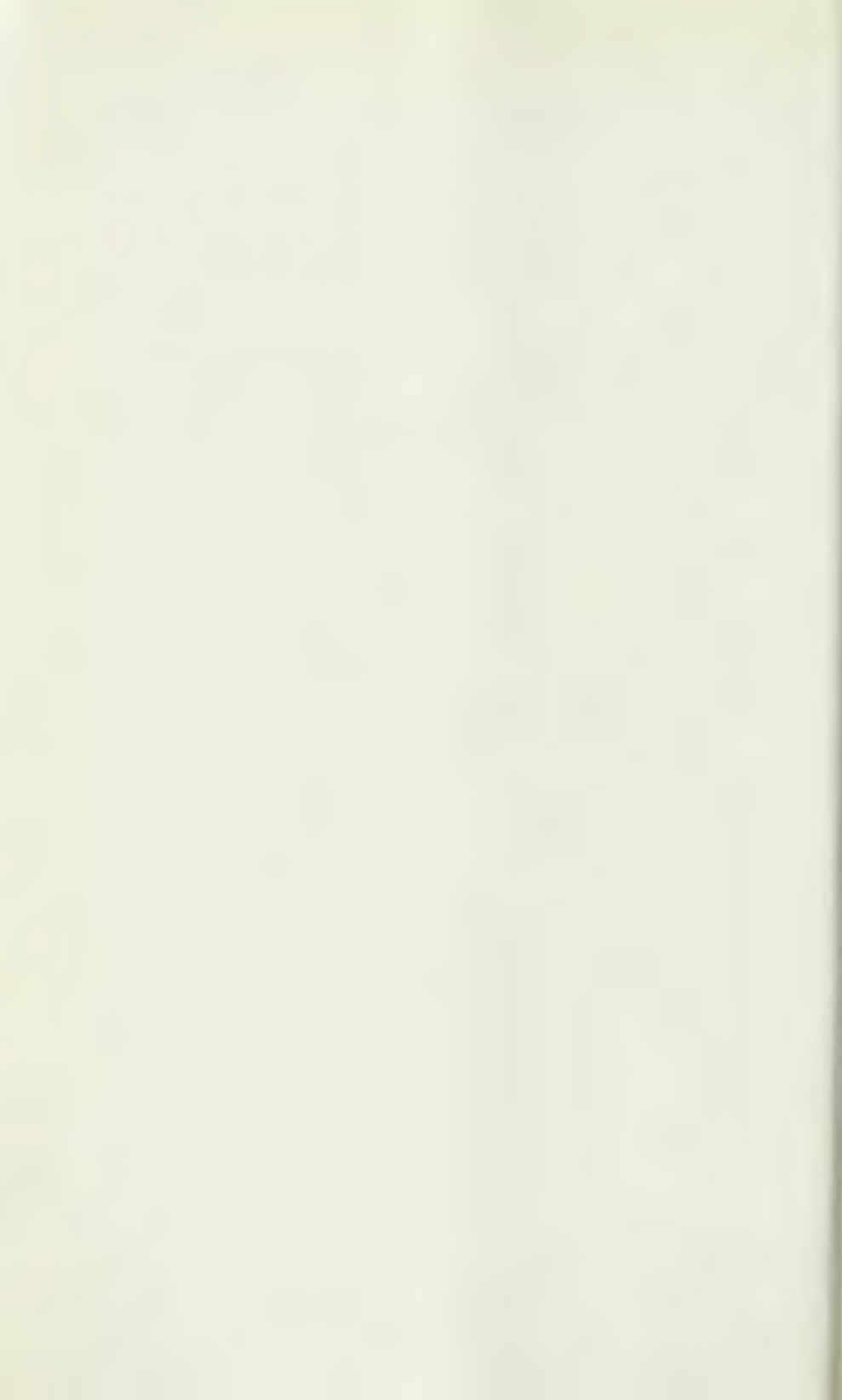


FIG. 6.—*Sparganium proliferum*, escaped from the cyst. Original. $\times 10$.



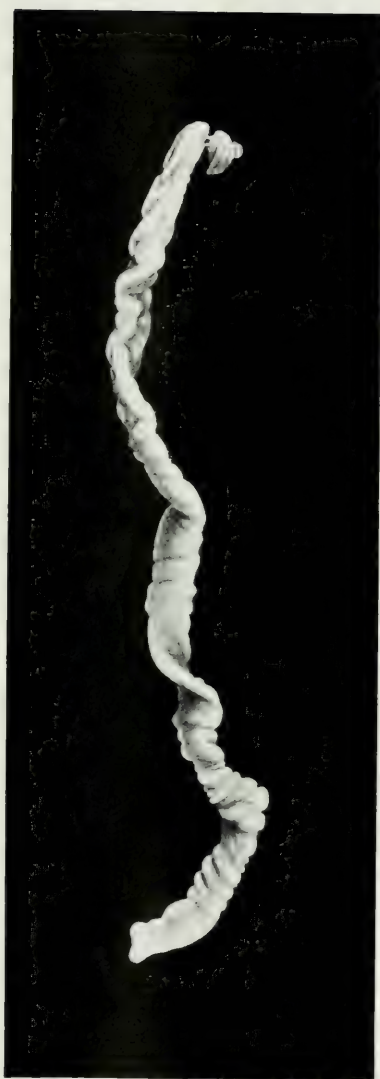
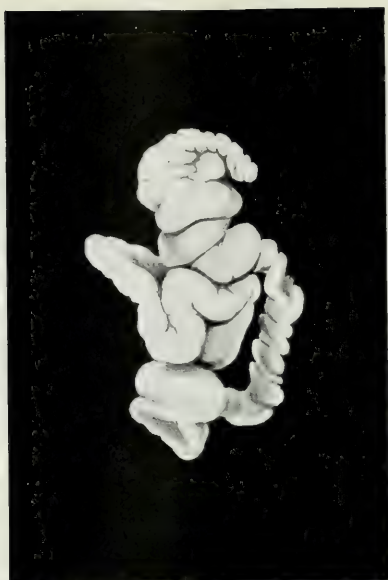


FIG. 7.

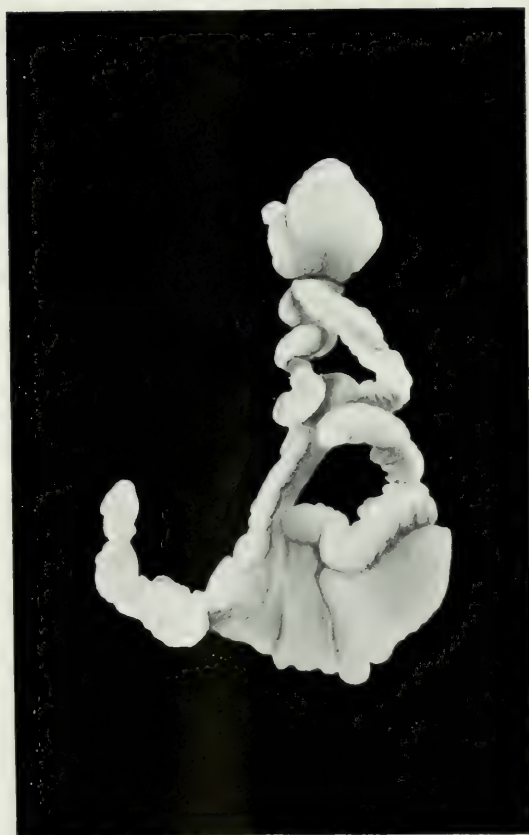
FIGS. 7-15.—Nine specimens of *Sparganium proliferum*, showing various forms, buds, and supernumerary heads. Original. $\times 10$.





L.M. WILDER DEL.

FIG. 8.



L.M. WILDER DEL.

FIG. 9.

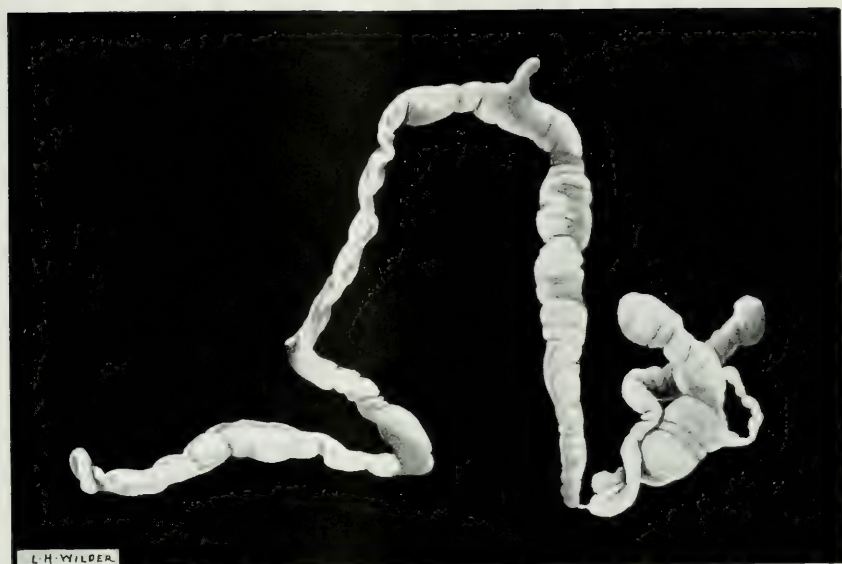
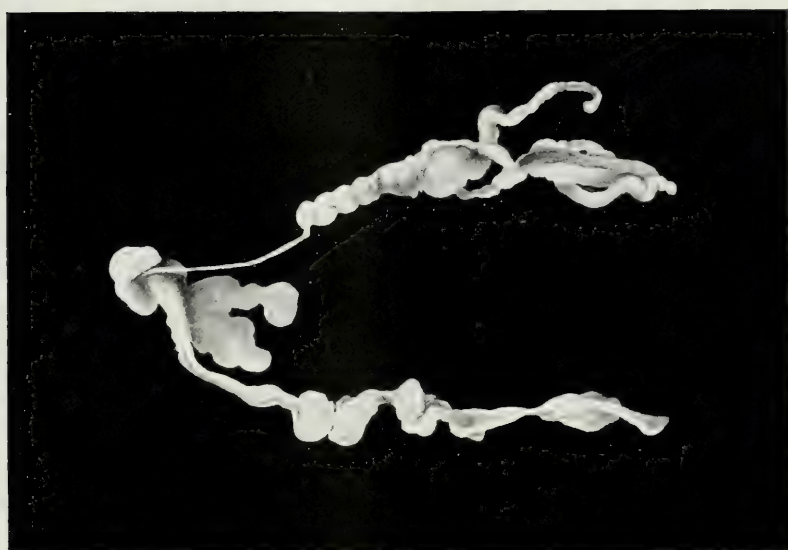


FIG. 10.



FIG. 11.





L. H. WILDER, DEL.

FIG. 12.

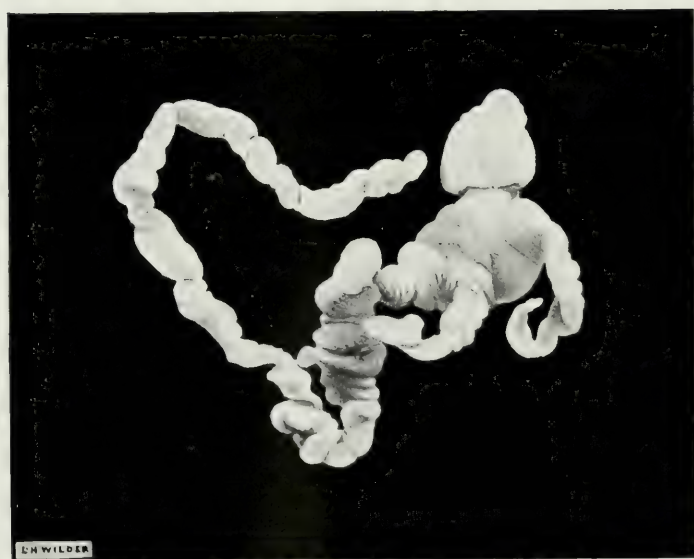


FIG. 13.

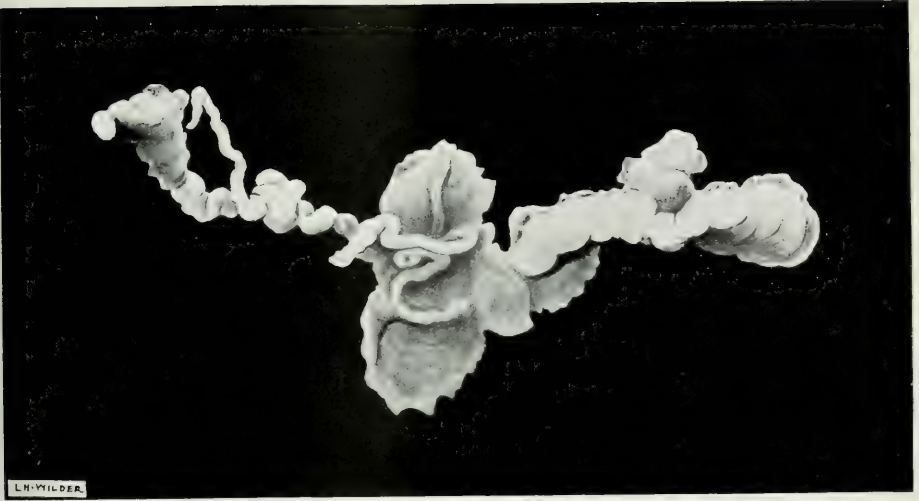


FIG. 14.

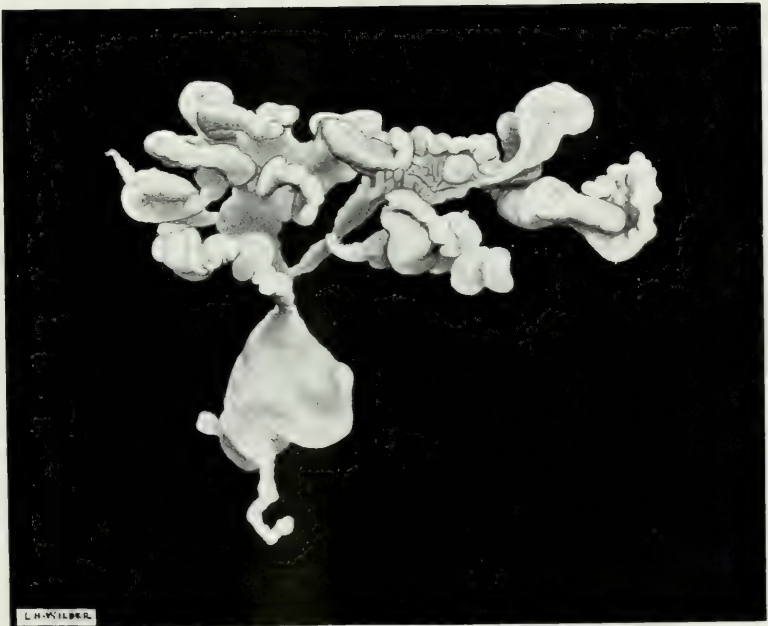


FIG. 15.



FIG. 16.—Section through a cyst (a), with the escaped *Sparganium proliferum* (b): x, reserve food particle. Original.



FIG. 17.—Section through a reserve food particle. (See x, fig. 16.) Enlarged. Original.



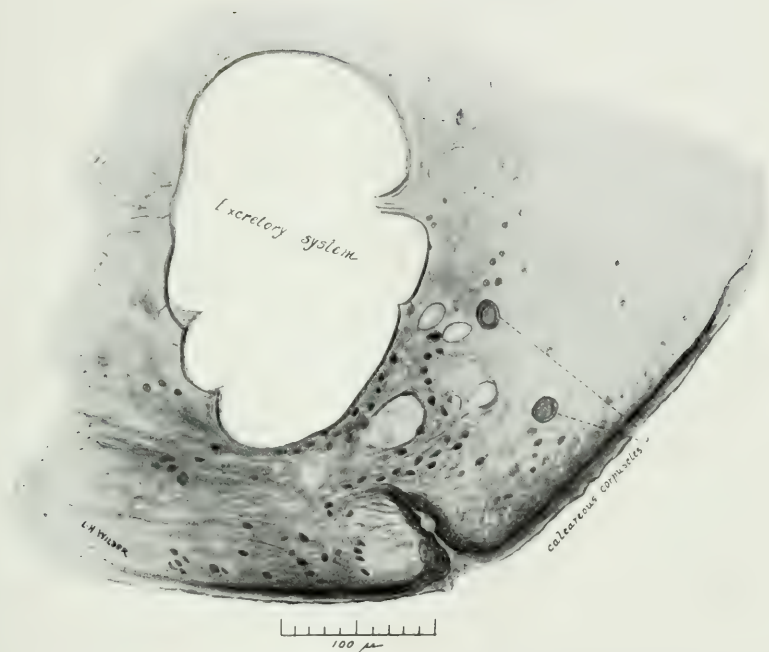


FIG. 18.—Section showing large excretory canal, smaller canals, calcareous corpuscles, and a pore.
Enlarged. Original.

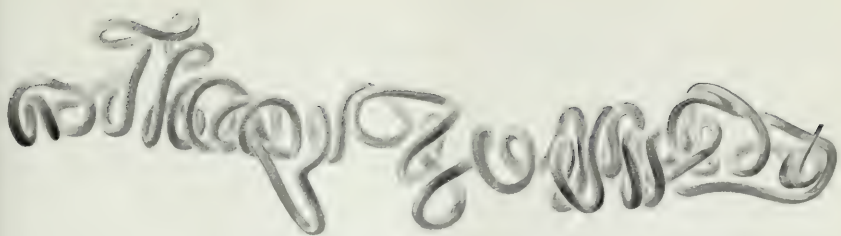


FIG. 21.

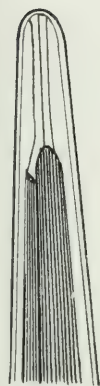


FIG. 19.

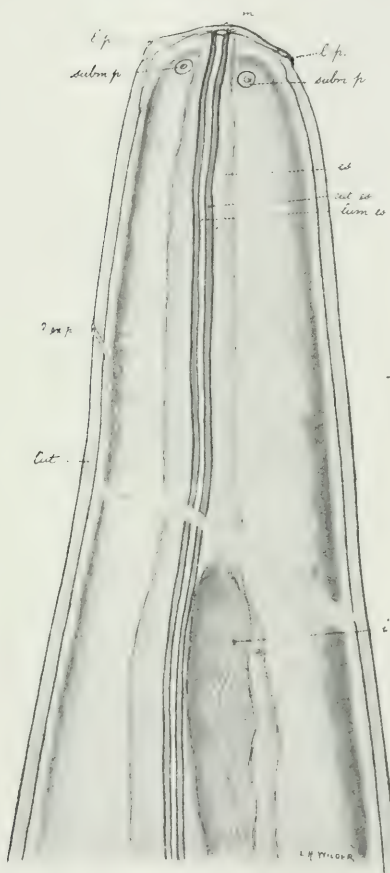


FIG. 22.



FIG. 20.

FIG. 19.—Head of *Filaria restiformis*. Enlarged. Leidy's original figure.

FIG. 20.—Tail of *F. restiformis*. Enlarged. Leidy's original figure.

FIG. 21.—Figure of type specimen of *F. restiformis*. Natural size. Original.

FIG. 22.—Enlarged view of head of same; the body is surrounded by a distinct cuticle (*cut.*); cuticle of esophagus (*cut. es.*); esophagus (*es.*); blind intestinal sac (*l.*); lumen of esophagus (*lum. es.*); a pair of lateral papillae (*l. p.*) and two submedian papillae (*subm. p.*) are visible; the mouth is terminal (*mc.*). Original.



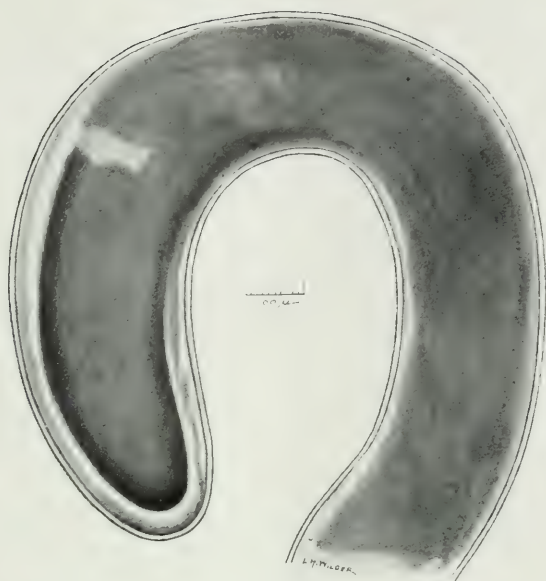


FIG. 23.

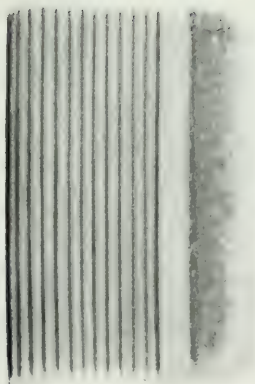


FIG. 24.



FIG. 25.

FIG. 23.—Tail of same; the dark body in the center represents the intestine. Enlarged. Original.
 FIG. 24.—Optical section of cuticle showing layers. Greatly enlarged. Original.
 FIG. 25.—Diagonal system of fibers of cuticle. Greatly enlarged. Original.



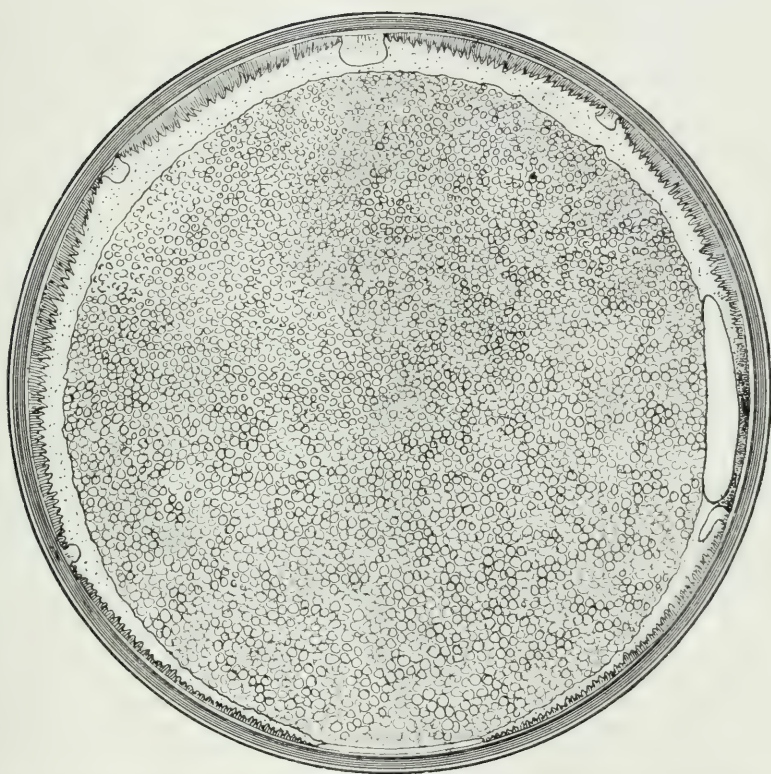


FIG. 26.—Transverse section of type specimen, showing 6 muscular fields, separated by 6 longitudinal lines; the central mass is the fat body. Greatly enlarged. Original.

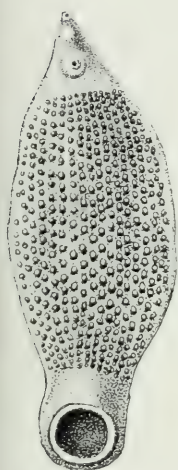


FIG. 27.



FIG. 29.



FIG. 28.

FIGS. 27-28.—*Homalogaster palonisi*. (After Poirier 1883, figs. 1a-b.)

FIG. 29.—*Homalogaster philippinensis*, ventral view. Enlarged. Original.



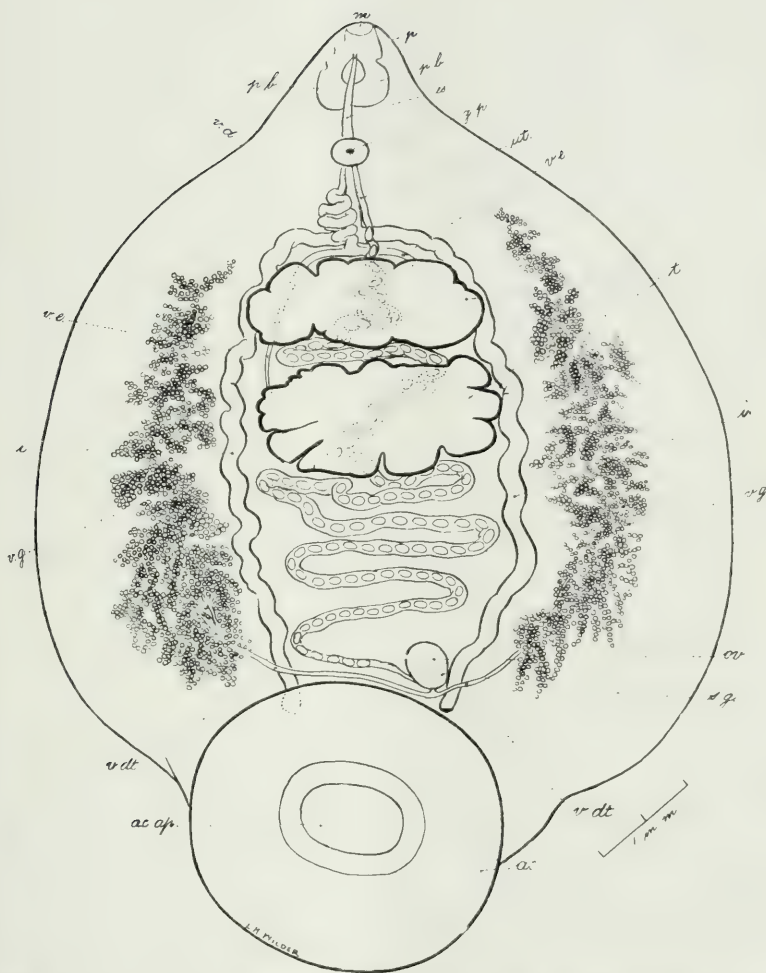


FIG. 30.—Press preparation of *Homologaster philippinensis*, showing internal anatomy: *ac.*, acetabulum; *ac. ap.*, aperture of acetabulum; *es.*, esophagus; *g. p.*, genital pore; *i.*, intestine; *m.*, mouth; *ov.*, ovary; *p.*, pharynx; *ph. b.*, pharyngeal pouch; *s. g.*, shell gland; *t.*, testis; *ut.*, uterus; *v. d.*, vas deferens; *v. e.*, vas efferens; *v. g.*, vitellogene gland; *v. dt.*, transverse vitello-duct. Enlarged. Original.

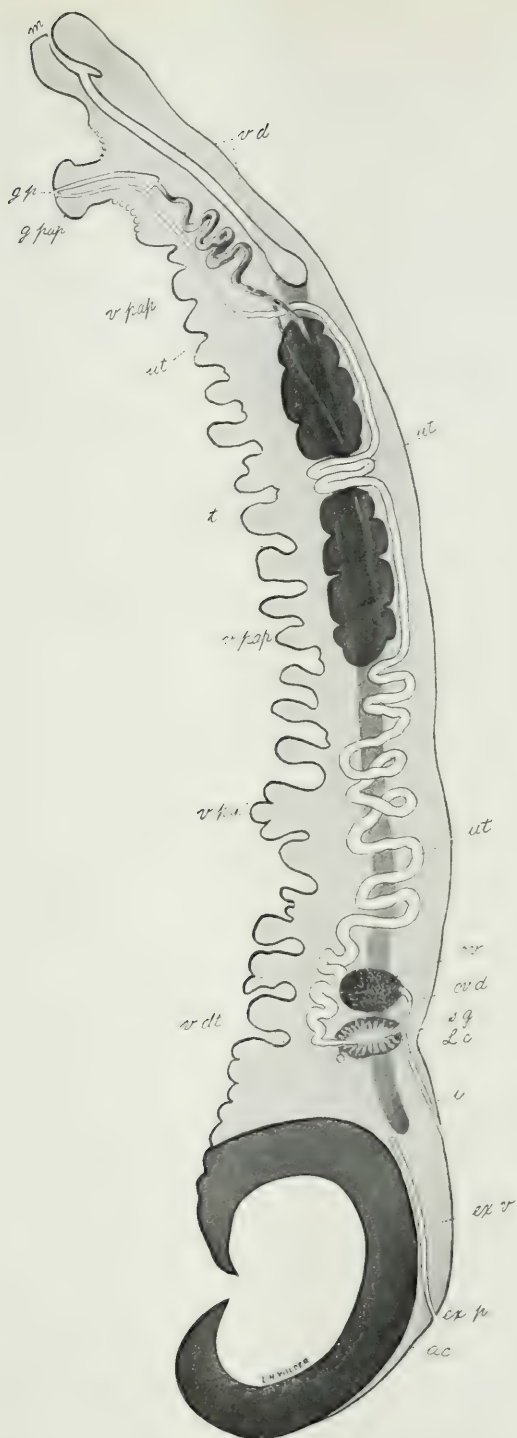


FIG. 31.—Optical, sagittal section showing internal anatomy: *ex. p.*, excretory pore; *ex. v.*, excretory vesicle; *g. pap.*, genital papilla; *L. c.*, Laurer's canal; *ov. d.*, oviduct; *v. p.*, ventral papillae. Remainder of lettering as in figure 30. Semidiagrammatic. Enlarged. Original.

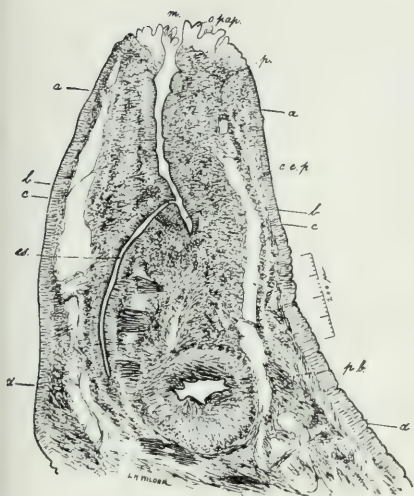


FIG. 32.

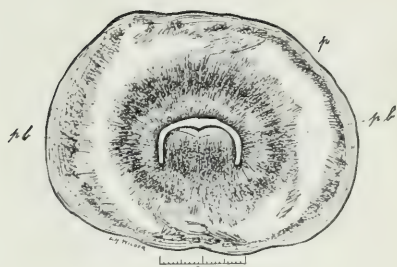


FIG. 34.



FIG. 35.

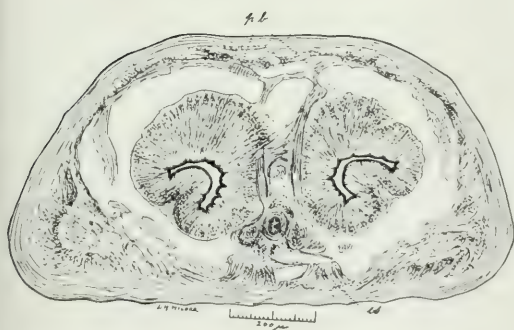


FIG. 36.



FIG. 33.

FIG. 32.—Sagittal section through oral extremity: *c. e. p.*, cecal extremity of pharynx; *es.*, esophagus; *m.*, mouth; *a. pap.*, oral papillae; *p.*, lumen of pharynx; *p. b.*, lumen of pharyngeal pouch; *a-a*, *b-b*, *c-c*, *d-d*, planes of section. Enlarged. Original.

FIG. 33.—Transverse section through plane *a-a* of figure 32, showing pharyngeal lumen (*p.*). Enlarged. Original.

FIG. 34.—Transverse section through plane *b-b* of figure 32, showing pharyngeal lumen (*p.*) and aperture of pharyngeal pouches (*p. b.*). Enlarged. Original.

FIG. 35.—Transverse section through plane *c-c* of figure 32, showing cecal extremity of pharynx (*c. e. p.*); beginning of esophagus (*es.*) and aperture of pharyngeal pouches (*p. b.*). Enlarged. Original.

FIG. 36.—Transverse section through plane *d-d* of figure 32, showing relative positions of esophagus (*es.*) and pharyngeal pouches (*p. b.*). Enlarged. Original.

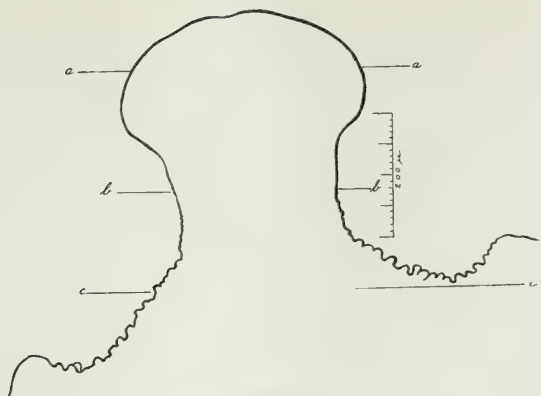


FIG. 37.

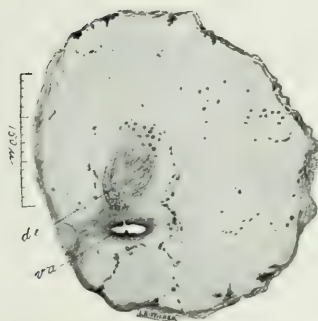


FIG. 38.

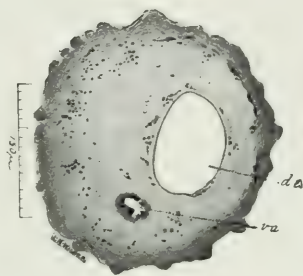


FIG. 39.

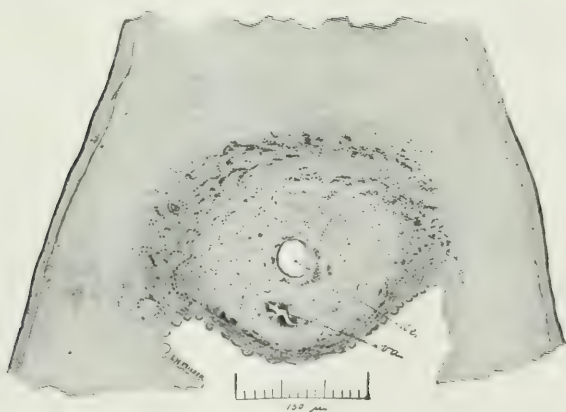


FIG. 40.

FIG. 37.—Outline of genital papilla in sagittal section, showing also the papillae around the base: *a-a*, *b-b*, *c-c*, planes of section. Enlarged. Original.

FIG. 38.—Section through genital papilla in plane *a-a*, of figure 37. The section is not quite at right angles to the axis of this papilla. It shows the metraterm (*va*) and the ductus ejaculatorius (*da*) filled with spermatozoa. Enlarged. Original.

FIG. 39.—Section through genital papilla in plane *b-b* of figure 37. Lettering as figure in 38. Enlarged. Original.

FIG. 40.—Section through genital papilla in plane *c-c* of figure 37. Lettering as in figure 38. Enlarged. Original.





FIG. 41.—Transverse section showing retracted genital papilla (*g. pap.*), esophagus (*es.*) and the papillae around base of genital papilla. Enlarged. Original.

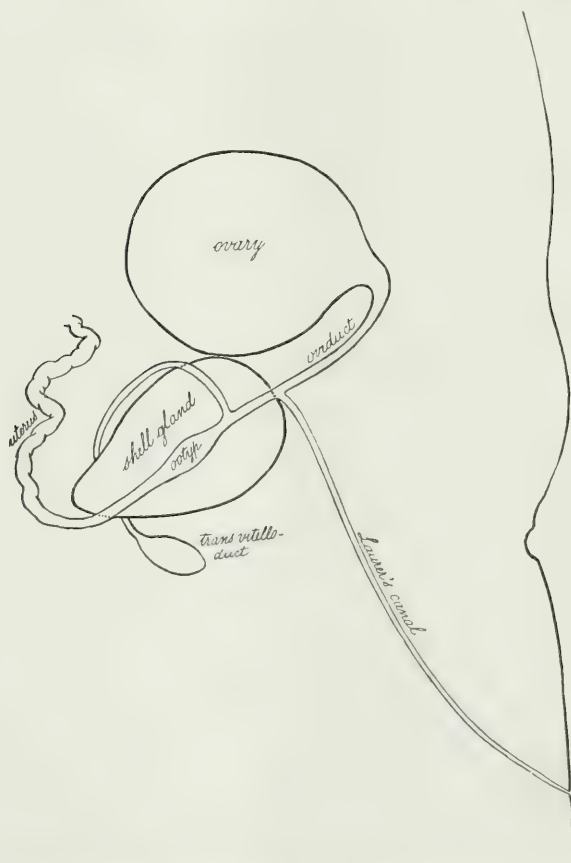


FIG. 42.—Diagram showing relation of ovary, shell gland, oviduct, ootyp, uterus, and Laurer's canal in sagittal plane. Original.

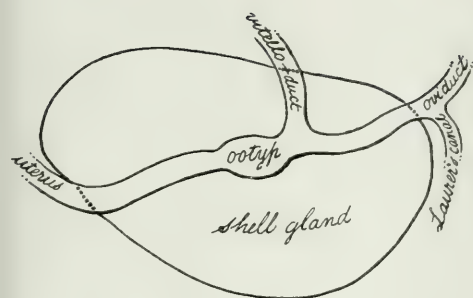


FIG. 43.



FIG. 44.

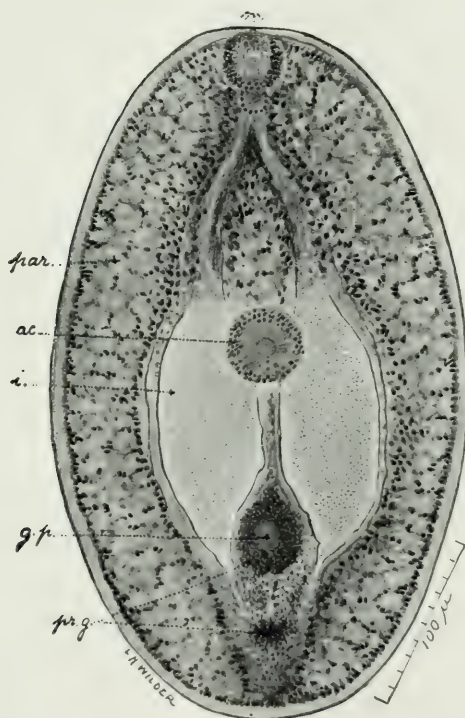


FIG. 45.

FIG. 43.—Diagram showing shell gland, ootyp, vitelloduct, uterus and Laurer's canal. Original.

FIG. 44.—Egg. Enlarged. Original.

FIG. 45.—Ventral view of *Agamodistomum minus*; ac., acetabulum; g. p., genital pore; i. fusiform intestine; m., oral sucker; par., foamy parenchyma; pr. g., primordium of genital glands.

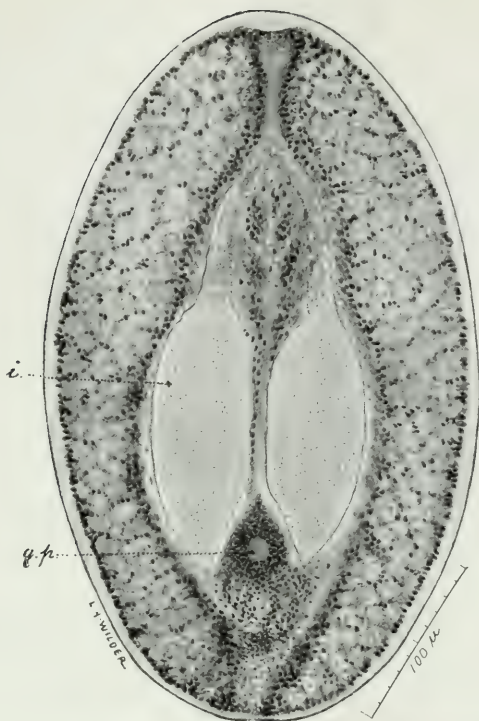


FIG. 46.—Dorsal view of *Agamodistomum nanus*. Lettering as in fig. 45.



FIG. 47.

FIGS. 47-53.—Series of 7 consecutive sagittal sections of cyst with contained parasite, showing anatomy of parasite from its right lateral margin to a plane on the left of the median line. Note the foamlike structure of the parenchyma of the worm, the fusiform intestine (*i.*, 50, 51, 53), the pharynx (*p.*, 51, 52), the acetabulum (*ac.*, 52), ventral genital pore (*g. p.*, 52), genital primordium (*pr. g.*, 52), and the dorsosubterminal excretory pore (*x. p.*, 52).



FIG. 48.

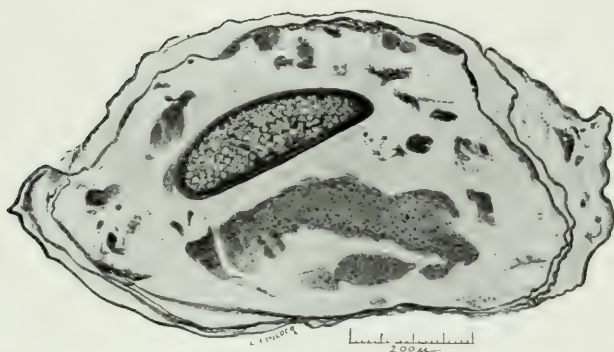


FIG. 49.



FIG. 50.

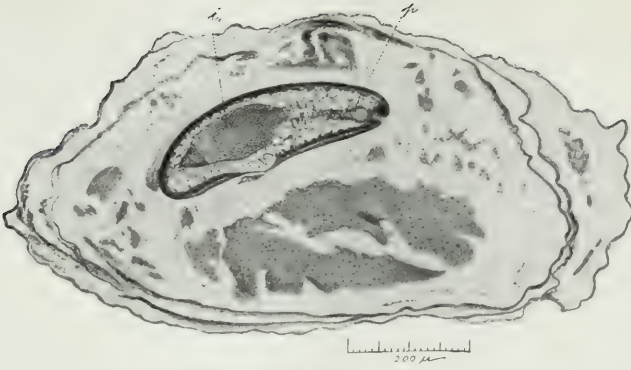


FIG. 51.



FIG. 52.



FIG. 53.



FIG. 54.



FIG. 55.



FIG. 56.

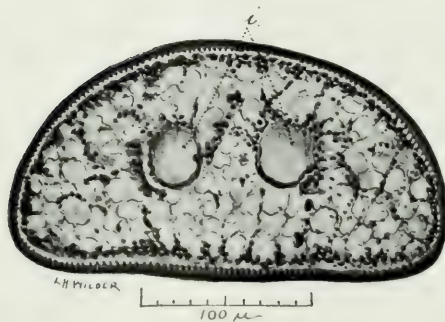


FIG. 57.

FIGS. 54-66.—Series of 13 consecutive transverse sections of *Agamodistomum nanus*, showing the anatomy. Note the esophagus (*es.*, 54), its bifurcation (*es.*, 55), the intestinal ceca (*c.*, 56 to 65), the ventral acetabulum (*ac.*, 60 to 61), the genital primordium (*pr. g.*) and pore (*g. p.*, 63 to 65), the excretory canals (*ex. c.*, especially in 65).

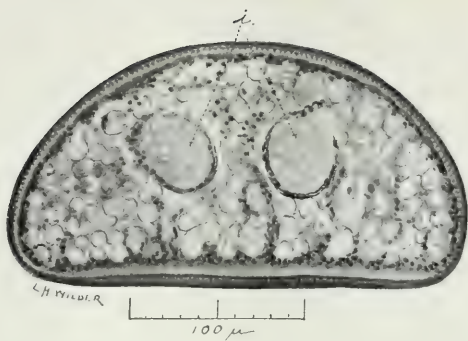


FIG. 58.

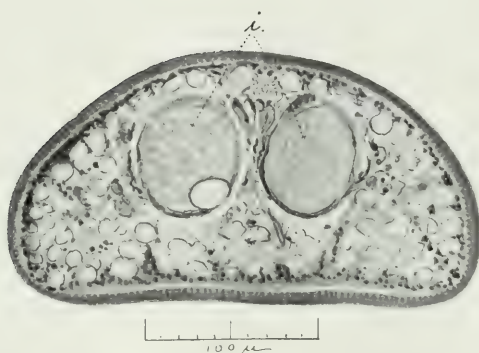


FIG. 59.

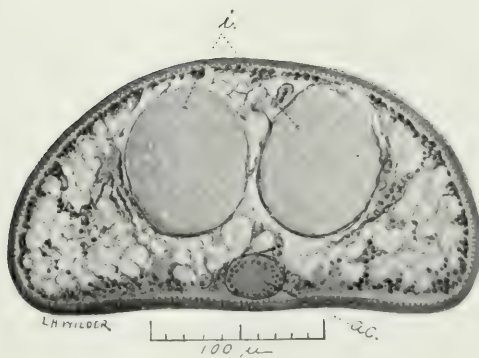


FIG. 60.

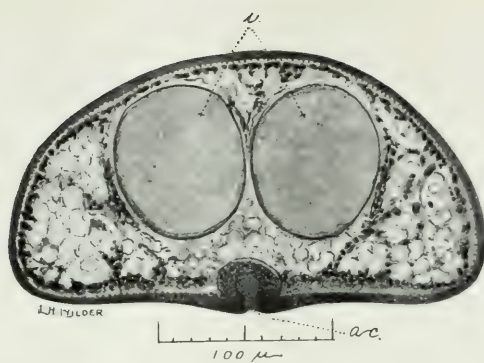


FIG. 61.

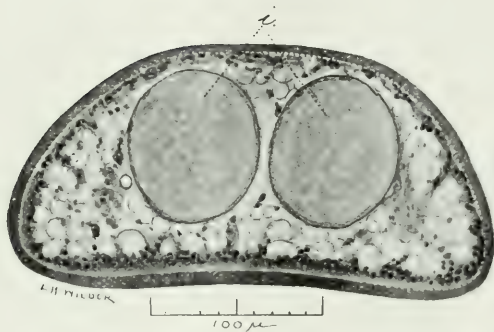


FIG. 62.

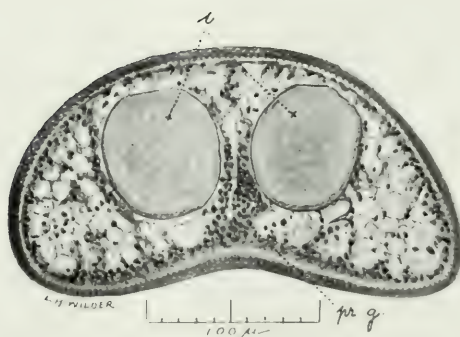


FIG. 63.

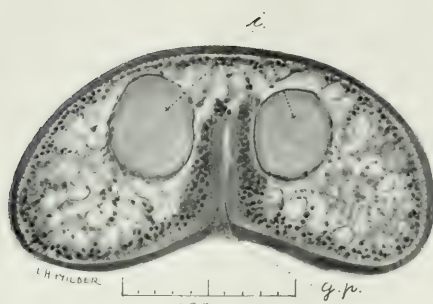


FIG. 64.



FIG. 65.



FIG. 66.

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The Hygienic Laboratory was established in New York, at the Marine Hospital on Staten Island, August, 1887. It was transferred to Washington, with quarters in the Butler Building, June 11, 1891, and a new laboratory building, located in Washington, was authorized by act of Congress, March 3, 1901.

The following *bulletins* [Bulls. Nos. 1-7, 1900 to 1902, Hyg. Lab., U. S. Mar.-Hosp. Serv., Wash.] have been issued.

No. 1.—Preliminary note on the viability of the *Bacillus pestis*. By M. J. Rosenau.

No. 2.—Formalin disinfection of baggage without apparatus. By M. J. Rosenau.

No. 3.—Sulphur dioxide as a germicidal agent. By H. D. Geddings.

No. 4.—Viability of the *Bacillus pestis*. By M. J. Rosenau.

No. 5.—An investigation of a pathogenic microbe (*B. typhi murium* Danyz) applied to the destruction of rats. By M. J. Rosenau.

No. 6.—Disinfection against mosquitoes with formaldehyde and sulphur dioxide. By M. J. Rosenau.

No. 7.—Laboratory technique: Ring test for indol. by S. B. Grubbs and Edward Francis; Collodium sacs. by S. B. Grubbs and Edward Francis; Microphotography with simple apparatus. by H. B. Parker.

By act of Congress approved July 1, 1902, the name of the "United States Marine-Hospital Service" was changed to the "Public Health and Marine-Hospital Service of the United States," and three new divisions were added to the Hygienic Laboratory.

Since the change of name of the Service the bulletins of the Hygienic Laboratory have been continued in the same numerical order, as follows:

No. 8.—Laboratory course in pathology and bacteriology. By M. J. Rosenau. (Revised Edition March, 1904.)

No. 9.—Presence of tetanus in commercial gelatin. By John F. Anderson.

No. 10.—Report upon the prevalence and geographic distribution of hookworm disease (uncinariasis or ancylostomiasis) in the United States. By Ch. Wardell Stiles.

No. 11.—An experimental investigation of *Trypanosoma lewisi*. By Edward Francis.

No. 12.—The bacteriological impurities of vaccine virus: an experimental study. By M. J. Rosenau.

No. 13.—A statistical study of the intestinal parasites of 500 white male patients at the United States Government Hospital for the Insane; by Philip E. Garrison, Brayton H. Ransom, and Earle C. Stevenson. A parasitic roundworm (*Agamomermis culicis* n. g., n. sp.) in American mosquitoes (*Culex sollicitans*); by Ch. Wardell Stiles. The type species of the cestode genus *Hymenolepis*; by Ch. Wardell Stiles.

No. 14.—Spotted fever (tick fever) of the Rocky Mountains: a new disease. By John F. Anderson.

- No. 15.—Inefficiency of ferrous sulphate as an antiseptic and germicide. By Allan J. McLaughlin.
- No. 16.—The antiseptic and germicidal properties of glycerin. By M. J. Rosenau.
- No. 17.—Illustrated key to the trematode parasites of man. By Ch. Wardell Stiles.
- No. 18.—An account of the tapeworms of the genus *Hymenolepis* parasitic in man, including reports of several new cases of the dwarf tapeworm (*H. nana*) in the United States. By Brayton H. Ransom.
- No. 19.—A method for inoculating animals with precise amounts. By M. J. Rosenau.
- No. 20.—A zoological investigation into the cause, transmission, and source of Rocky Mountain "spotted fever." By Ch. Wardell Stiles.
- No. 21.—The immunity unit for standardizing diphtheria antitoxin (based on Ehrlich's normal serum). Official standard prepared under the act approved July 1, 1902. By M. J. Rosenau.
- No. 22.—Chloride of zinc as a deodorant antiseptic and germicide. By T. B. McClintic.
- No. 23.—Changes in the Pharmacopœia of the United States of America. Eighth Decennial Revision. By Reid Hunt and Murray Galt Motter.
- No. 24.—The International Code of Zoological Nomenclature as applied to medicine. By Ch. Wardell Stiles.
- No. 25.—Illustrated key to the cestode parasites of man. By Ch. Wardell Stiles.
- No. 26.—On the stability of the oxidases and their conduct toward various reagents. The conduct of phenolphthalein in the animal organism. A test for saccharin, and a simple method of distinguishing between cumarin and vanillin. The toxicity of ozone and other oxidizing agents to lipase. The influence of chemical constitution on the lipolytic hydrolysis of ethereal salts. By J. H. Kastle.
- No. 27.—The limitations of formaldehyde gas as a disinfectant, with special reference to car sanitation. By Thomas B. McClintic.
- No. 28.—A statistical study of the prevalence of intestinal worms in man. By Ch. Wardell Stiles and Philip E. Garrison.
- No. 29.—A study of the cause of sudden death following the injection of horse serum. By M. J. Rosenau and John F. Anderson.
- No. 30.—I. Maternal transmission of immunity to diphtheria toxin. II. Maternal transmission of immunity to diphtheria toxin and hypersusceptibility to horse serum in the same animal. By John F. Anderson.
- No. 31.—Variations in the peroxidase activity of the blood in health and disease. By Joseph H. Kastle and Harold L. Amoss.
- No. 32.—A stomach lesion in guinea pigs caused by diphtheria toxin and its bearing upon experimental gastric ulcer. By M. J. Rosenau and John F. Anderson.
- No. 33.—Studies in experimental alcoholism. By Reid Hunt.
- No. 34.—I. *Agamofilaria georgiana* n. sp., an apparently new round-worm parasite from the ankle of a negress. II. The zoological characters of the round-worm genus *Filaria* Mueller, 1787. III. Three new American cases of infection of man with horsehair worms (species *Paragordius varius*), with summary of all cases reported to date. By Ch. Wardell Stiles.
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